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December, 1953

SCIENCE AND INDUSTRY

THE JOURNAL OF GLASS MANUFACTURING

the glass industry

• • Supervision in Brockway Glass Company's Decorating Department. C. E. Doolittle, Manager, discusses the operation of a fully automatic decorating machine, while a defect is explained to an inspector.

what do YOU pay for cooling?

$2.85 per hour?

$4.17 per hour?

_____per hour?

The operating cost *alone* of cooling systems for an average furnace and machine layout may approximate $500,000 over a twenty year period. While it may be impossible to compare your cooling operation costs to an average figure, your figure should make it clear that *efficient* cooling is a must in glass plant operation.

Too much operating pressure at the fan . . . too little pressure at the cooling nozzles, may cost you a a thousand dollars or more per year. These pressures and many other factors relating to operating economy, may be checked quickly and easily by a Kirk & Blum engineer.

KIRK AND BLUM

GLASS COOLING SYSTEMS

If you don't know what cooling is costing you . . . even if you think it's "about right" . . . a no-cost, no-obligation survey by Kirk & Blum may point the way to important savings. *Write today for literature and complete information: The Kirk & Blum Mfg. Co., 3104 Forrer St., Cincinnati 9, Ohio.*

FOR ADDED SERVICE AND LONGER LIFE

the SIMPLEX designed

SUSPENDED SHADOW WALL

At top, Outside view over top of shadow wall showing support steel and two of the adjustable hanger bolts at the far end.

The adjustable Suspended Shadow Wall is a development of Simplex engineers and there are many sheet glass tanks now equipped with this effective means for controlling the glass working temperature. The nose and wall in the illustration at the left are 12" thick silica tiles both interlocked and bonded. These shadow walls are approximately 7' 7" deep and run 29' or more in length. Total suspended weight is approximately 73,000 pounds. On heating up, the nose and wall increase about 5" in length.

These shadow wall installations have conclusively proved their practicability and value in providing increased flexibility on large melting operations.

CONSULT OUR ENGINEERS FOR FURTHER ADVICE.

FRAZIER-SIMPLEX, INC.
Engineers
428 EAST BEAU ST.—WASHINGTON, PENNA.

AN OGDEN PUBLICATION DEVOTED TO GLASS TECHNOLOGY, ENGINEERING, MATERIALS AND GLASS FACTORY EQUIPMENT AND OPERATION

the glass industry

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UNRETOUCHED PHOTOGRAPH

ZAC THROAT IN BROCKWAY TANK AFTER 107,581 TONS!

This photo shows the Corhart Zac throat and melting-end bridgewall of a Brockway Glass Company container tank, recently shut down after an 1152-day campaign on soda-lime flint glass. Corhart Zac was also used in the sidewalls and superstructure.

OPERATING DATA

GLASS	Soda-Lime Flint	
SIZE	Square Feet of Melting Area	516
	Sidewall Height in Inches	42
LIFE	Total Operating Days	1,063
	Total Idle Days	89
	Total Days	1,152
PULL	Tons Glass Melted	107,581
	Tons Glass Per Operating Day	101.2
	Tons Glass Per Square Foot Melting Area Per Life	208.49
	Square Feet Melting Area Per Ton Glass Per Operating Day	5.10
FUEL	Producer Gas	
	TON=2,000 LBS.	

Complete operating data in the box testifies to excellent design, smart operation, good refractories.

For Brockway, as for scores of other progressive operators, Corhart Zac has proved that it more than "pays its way" in *long life, low operating costs and high production.* If your refractories aren't delivering this kind of efficient, low-cost performance, let us talk with you soon about Corhart Zac. Corhart Refractories Co., *Incorporated,* 1600 West Lee Street, Louisville 10, Kentucky, U.S.A.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

The words "CORHART", "ZAC", and "ELECTROCAST" are registered Trade Marks which indicate manufacture by Corhart Refractories Company, Incorporated.

The NEW AIR CLAD TECO BURNER

affording improved flame control with related advantages . . .

- Gives heretofore unavailable control of flame as to length and placement.
- Effects savings in fuel and refractories by preventing flame carry-over.
- A combination burner affords the above advantages when firing with gas.

And, when burning oil, freedom from carbonization from radiant heat as the burner tip is kept relatively cool.

This small device of tremendous importance is available to improve your operations. Write for facts.

Cable Address "TECOGLAS"

TOLEDO ENGINEERING Company

GLASS MELTING and MANUFACTURING EQUIPMENT

. . . 958 Wall St., TOLEDO, O.

Seasons Greetings

Gay spirits are more commonplace during the Yule Season than at any other time of the year. We extend to you our best wishes for a

HAPPY HOLIDAY SEASON

May good health and prosperity be yours throughout the coming year. Peace, love of life, kindliness and the brotherhood of all people.

Phone or wire for immediate delivery.

THE O. HOMMEL CO. PITTSBURGH 30, PA.

POTTERY • STEEL AND CAST IRON MUFFLE
CERAMIC COLORS • CHEMICALS • SUPPLIES
Our Technical Staff and Samples are available to you

"THE WORLD'S MOST COMPLETE CERAMIC SUPPLIER"

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PULP AND PAPER

SOAP

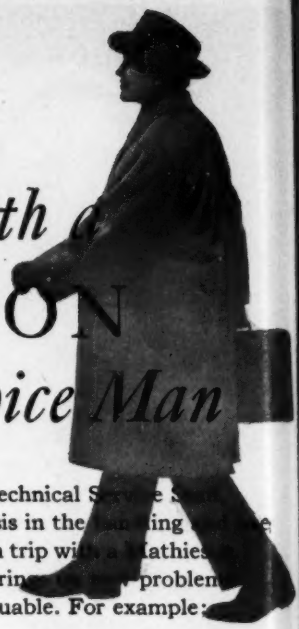
GLASS

TEXTILES

IRON AND STEEL

PETROLEUM

WATER AND SEWAGE



Take a trip with a
MATHIESON
Technical Service Man

This man, typical of the Mathieson Technical S[illegible] is experienced on an industry-wide basis in the [illegible]ing [illegible] of industrial chemicals. Every day, as a trip wi[illegible]athies[illegible] Technical Service Man would show, brin[illegible] problem[illegible] on which his broad experience is invaluable. For example:

A paper mill in New England is visited and advised on super-bleaching with chlorine dioxide. A soap manufacturer in the Middle West wishes to discuss the advantages of low-iron caustic. A chemical plant in the East is counseled on the storage and handling of sulphuric acid. Several Southern textile mills are visited in connection with the storage of soda ash. A gray-iron foundry in Ohio is advised on controlling sulphur with Purite. A glass plant in the Southeast wants information on soda ash and nitrate of soda. A petroleum refinery in the Southwest seeks assistance on the handling of caustic soda, and several water works are advised on taste and odor control with chlorine dioxide.

And so it goes. More and more, industry is looking to Mathieson Technical Service for practical assistance on the handling and use of basic chemical raw materials. A call to your Mathieson representative is all that's needed to avail yourself of this industry-wide experience.

MATHIESON

MATHIESON CHEMICAL CORPORATION
Mathieson Industrial Chemicals Division
Baltimore 3, Maryland

2022

caustic soda • soda ash • chlorine • sulphur • bicarbonate of soda
dry ice and carbonic gas • ammonia • sodium nitrate • nitric acid
hydrazine products • sodium methylate • sodium chlorite • hypochlorite
products • sulphuric acid • ethylene glycols and oxide • methanol

WHERE GLASS MANUFACTURERS USE B&W REFRACTORIES *for Longer Campaigns*

These glassmakers proved to themselves that B&W's specialized refractories paid off in longer campaigns. Why not use them in your tanks?

PLANT	LOCATION OF B&W REFRACTORIES
New York Manufacturer of Container Glass	B&W Dense 80 Firebrick in 1st & 2nd ports. B&W 80 Firebrick in checkers.
Ohio Manufacturer of Clear Glass	B&W 80 Firebrick in port construction, regenerator arches and walls, and top 8 to 10 courses of checkers. B&W Juniors in wall type checkers. B&W Allmul burner blocks.
Ohio Manufacturer of Container Glass and Colored Borosilicates	B&W Dense 80 and Junior Firebrick in checkers. B&W Dense 80's in burner block necks and B&W Juniors in ports.
Pennsylvania Manufacturer of Container Glass	B&W 80 Firebrick in ports, regenerator arches and walls as well as top 10 to 14 courses of checkers.
West Virginia Manufacturer of Glass for Fluorescent Lamps	B&W Junior Firebrick in checkers and ports.
Kentucky Manufacturer of Glass for Bulbs	B&W 80 Firebrick in ports, and B&W Junior Firebrick in checkers.
West Virginia Manufacturer of Plate and Window Glass	B&W 80 Firebrick in ports and regenerator crowns.
Pennsylvania Manufacturer of Container Glass	B&W Allmul Firebrick used in complete refining end.

PROPERTIES OF B&W HEAVY FIREBRICK

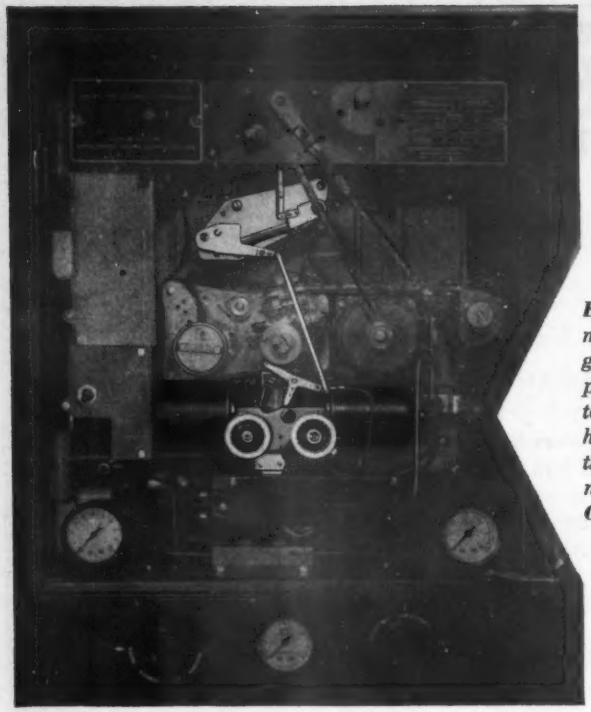
	B&W ALLMUL	B&W 80	B&W JUNIOR
Recommended use limit, F	3200	2950	2850
Fusion point, F	3335	3190	3173
Hot load strength, % deformation, 25 psi, 1½ hours	Less than 2% @ 3050F	Less than 1% @ 2640F	Less than 2% @ 2640F

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 161 EAST 42nd ST., NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

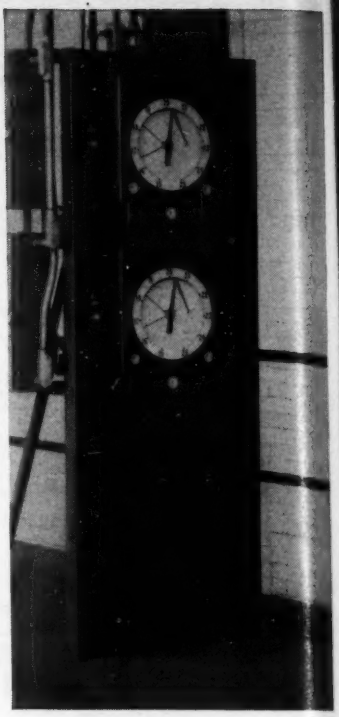
B&W REFRACTORIES PRODUCTS—B&W Allmul Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

B475



The news is inside!

ElectroniK instruments on this typical glass feeder control panel can hold glass temperatures to even higher precision because they now embody the new Narrow Band Air-O-Line Control Unit.



Closer control of feeder temperatures *through new Air-O-Line Control Unit*

HERE'S NEWS for glass plants! The new Narrow Band *Air-O-Line* Control Unit now makes it possible to pin down critical feeder and forehearth temperatures more closely than ever before . . . through faster, more sensitive response of fuel input to temperature changes.

The new *Air-O-Line* unit is especially designed for the unusual control sensitivity that this application requires. It has an exceptionally narrow proportional band which can be adjusted accurately from 14% down to 1%. This means that extremely small variations in temperature cause relatively large changes in the position of the fuel valve. For example, with a 2% band setting, a change of only *one* degree (on an instrument with a 1000° span) would make the control valve move through 5% of its travel. This greater sensitivity also makes possible faster corrective action.

It's easy to adjust the band to the exact percentage needed for your installation, because the entire range from 1 to 14% takes almost a full turn of the adjustment dial. Like all *Air-O-Line* units, the new model embodies automatic reset to accommodate for variations in output, fuel pressure, and similar changes. This unit is supplied as an integral part of *ElectroniK* circular chart temperature controllers. Existing *Air-O-Line* units can be converted in the field to the new design.

Your local Honeywell engineering representative will be glad to discuss how this new unit can aid your glass production . . . and he's as near as your phone.

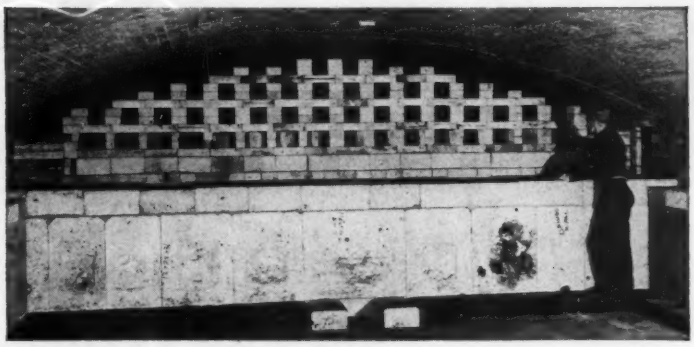
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA:** Write for Supplementary Bulletin 504-S "Narrow Band *Air-O-Line* Control Unit."

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls

The trend is to **MONOFRAX®** **FUSED CAST** *refractories*

The extra-high purity and durability of MONOFRAX refractories are real assets to this best quality tank crystal. Type "MH" is used for the bridgewall, throat, sump, and doghouse sidewalls. Type "H" is used for the tuckstones and port bottoms for the full length of the tank; also for the port jambs and breastwalls through the first two (of four) ports. Gas is the fuel, with oil standby.



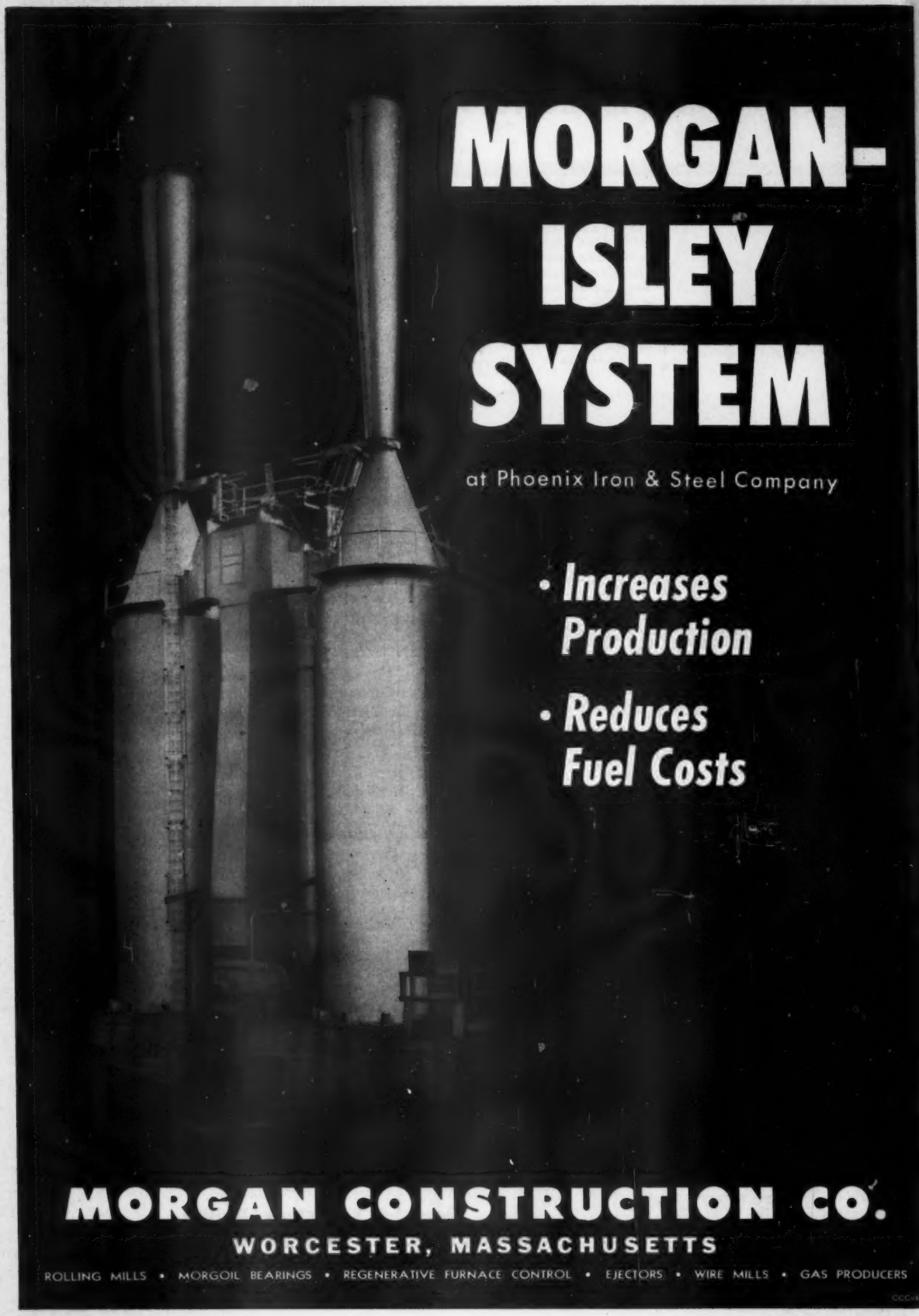
HOW FAST A BLOCK ERODES is largely determined by the composition of the interface, that thin film between the refractory and the glass. The greater the viscosity of the interface, the slower the erosion. The interface formed by MONOFRAX MH fused cast refractories, for example, slows the flow of glass adjacent to the refractory to 1/40 or 1/50 the rate in the melting end of the tank! This is due to the fact that MONOFRAX MH refractories are practically pure alumina (over 98%), which results in a high-viscosity interface. The physical structure of this refractory — a combination of interlocked alpha and beta alumina crystals — also helps make it one of the densest, longest lasting refractories available. Moreover, its high alumina content insures maximum glass purity. The impurities in MONOFRAX MH refractories total less than 0.07%. It is *the purest of all* commercial refractories for glass furnace use.

FOR A PERFECT SEAL between feeder bushing and feeder spout, FIBERFRAX® ceramic fiber is proving the answer for more and more glass operators. They find this cottony material doesn't vitrify like cement. Now bushing change is possible with minimum loss in time. Besides, there is no sticking and practically no glass clearing time is required.

CARBORUNDUM
Trade Mark

Dept. J-53 Refractories Division
The Carborundum Company, Perth Amboy, N. J.

"CARBORUNDUM" AND "MONOFRAX" ARE REGISTERED TRADEMARKS OF THE CARBORUNDUM CO. — WORLD'S LARGEST MANUFACTURER OF SUPER REFRACTORIES.


MORGAN-
ISLEY
SYSTEM
at Phoenix Iron & Steel Company
• Increases Production
• Reduces Fuel Costs
MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS
ROLLING MILLS • MORGOIL BEARINGS • REGENERATIVE FURNACE CONTROL • EJECTORS • WIRE MILLS • GAS PRODUCERS

SOMEDAY . . . *it will be for real!*

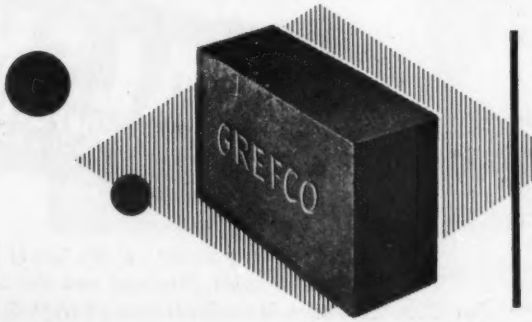
Building with blocks is as much a part of a young boy's life as baseball will be in his teens. Blocks—one on top of the other—to satisfy the typically male urge to create.

As the years roll by, this boy will go on to build bridges or buildings, to make his career in the laboratories of chemical research—or to watch steel being born from ore and earth.

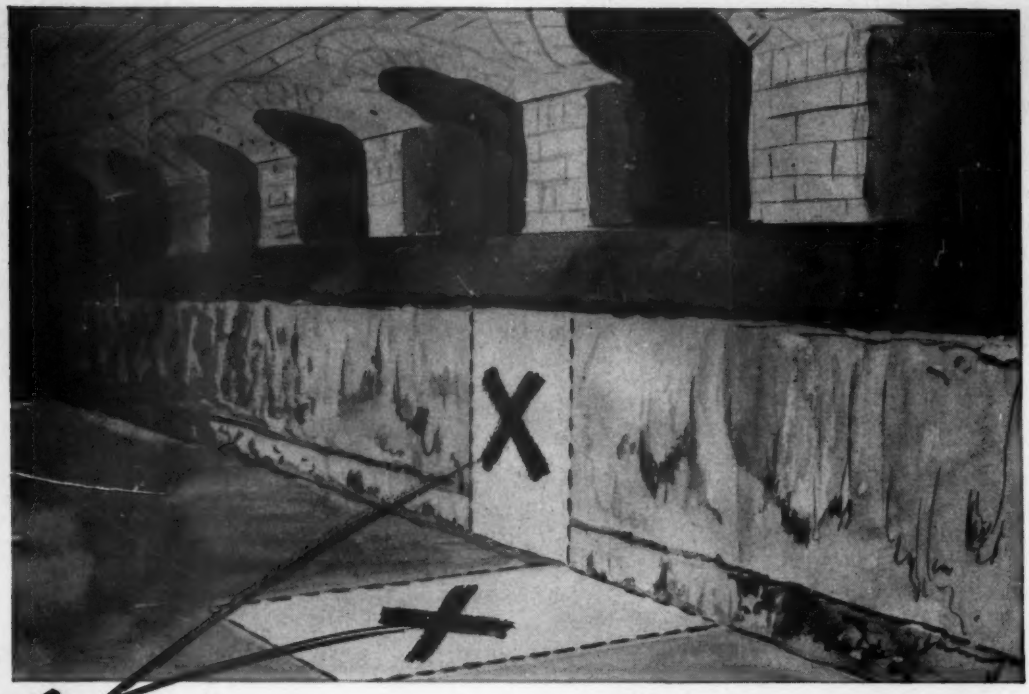
Whatever his future, there will be refractory brick to help him do his job. Blocks of brick to line the furnaces and heat containing vessels—in virtually every step of industry.

There would be no processed raw materials, no production, no living such as we know it but for refractory products which Grefco furnishes in quality and quantity to keep the nation on the move.

To the boy above, a very Merry Christmas and a great many Happy and Prosperous New Years. In his hands lies the future of America.



GENERAL REFRACTORIES COMPANY
Philadelphia



X MARKS THE SPOT...

WHERE YOU NEED MULLIFLUX TANK BLOCKS

As an added convenience, distinctive markings on each block readily identify Cast Mulliflux: "B" for Bottoms, "S" for Sidewalls.

If you have an unusual refractory problem, if you have difficulty in reaching and maintaining desired refractory service life, if you have *any* glass house refractory problem at all, it will pay you to investigate the outstanding properties of new Walsh Mulliflux Tank Blocks for sidewalls and bottoms of modern glass melting furnaces. Always the right answer to the need for lower cost per ton of glass melted. Mulliflux represents a supreme achievement based on over 50 years experience in developing glass house refractories that yield maximum life and economy. Before you rebuild, investigate the unique properties of Walsh Mulliflux tank blocks. Write for details.

OTHER WALSH PRODUCTS FOR THE GLASS INDUSTRY

Missouri-Quality Fire Brick

Walsh Mullitex, super duty. Dry press process. Tunnel kiln burned.

Walsh Mullitex H B ("high burn") special super duty. Dry press process. Tunnel kiln burned. 100% Missouri clays.

Cast Sillimanite Refractory

Walsh CSR. For safer, longer lasting protection in glass tank upperstructures.

Walsh CSR (Fortified). For extra life in upperstructure "tough spots". P. C. E. Cone 39 (3389 deg. F.)

. . . also Cast-Flux, Vacuum Cast Tank Blocks; Debiteuse; Refractory, Upper Structure Grade; Floaters, Channels, Feeder Parts; Pot Furnace Refractories; Prepared Clays and High Temperature Cements.

Each time-tested Walsh product for the glass industry is an investment in greater production . . . lower cost . . . result of better Walsh research and ceramic engineering.

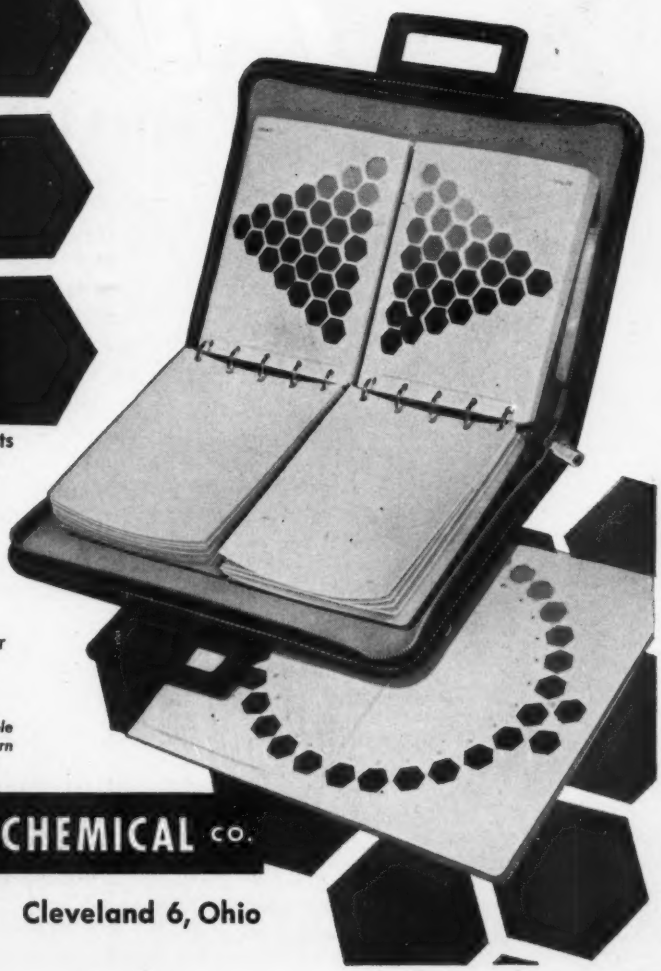
WALSH
REFRACTORIES CORPORATION
ST. LOUIS, MISSOURI, U.S.A.

101 Ferry Street • St. Louis 7, Mo.
Factories: St. Louis, Missouri and Vandalia, Missouri
For Over 50 Years Manufacturers of High Grade Refractories

NOW you can speed color matches by easy reference to the

943 colors

in the Color Harmony Manual*



Harshaw laboratories, field service men, and salesmen now use the Color Harmony Manual. You can send code identification by number of colors you want matched, direct or through our men by telephone, telegraph, or mail, saving costs and delays in handling bulky standard samples.

While not all of the colors listed in the manual can be matched in every ceramic medium, and while many colors you desire may fall between reference standards, the manual does encompass nearly the entire ceramic range.

The use of the Color Harmony Manual is another example of Harshaw's progressive attack on ceramic color problems.

**The Color Harmony Manual is copyrighted by and available from The Container Corporation of America, 38 South Dearborn Street, Chicago 3, Illinois.*

THE HARSHAW CHEMICAL CO.

Cleveland 6, Ohio

Glaze Stains
Underglaze Colors
Overglaze Colors

Glass Enamels
Enamel Oxides

this is a mighty poor substitute...

. . . it's just a picture of a wish of ours at Christmas Time. We wish we could shake hands with all our friends in the Glass Industry and say, "Merry Christmas and a prosperous New Year to you." Since that is impossible, please know that at this Christian Holiday of Hope and Good Will each and everyone at Overmyer sends Greetings. Yes, it's a mighty poor substitute, but a sincere one.

Overmyer

A PART IN THE PROGRESS OF GLASS

MOULD COMPANY, INC.

General Offices, Main Plant and Foundry Division: Winchester, Indiana
Eastern Plant: Greensburg, Pennsylvania
Western Plant: South Gate, California

For production on an even level

Uniform production depends largely upon uniform ingredients. The uniformity of Nialk chemicals is recognized throughout the chemical-using industries.

a typical example...

NIALK CARBONATE OF POTASH: Steady production in the manufacture of top quality glass is maintained only when the uniform purity of all ingredients is assured. That's why NIALK Carbonate of Potash is widely used for the smooth production of finest quality glassware.

This uniformity in all NIALK chemicals is an important factor in keeping production on an even level in many fields.

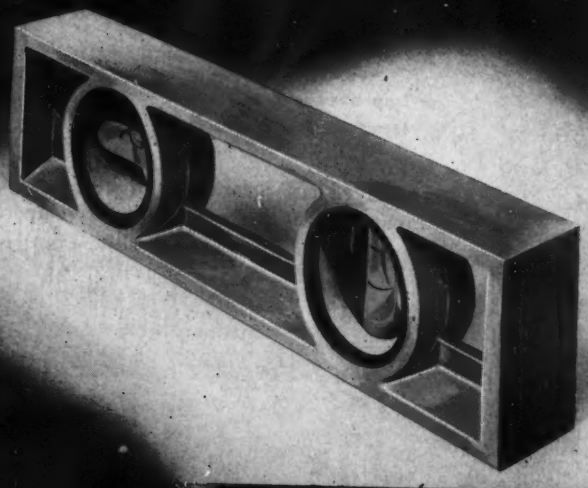
NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York

Nialk®

- LIQUID CHLORINE
- CAUSTIC POTASH
- CARBONATE OF POTASH
- PARADICHLOROBENZENE
- CAUSTIC SODA
- TRICHLORethylene

NIAGATHAL® (TETRACHLORO PHTHALIC ANHYDRIDE)



50 years

of

powered flight

Continuous Gas-fired Furnace in use in conveyorized production line for Solaramic Jet parts.

Ceramic Coating of Jet Engine Parts

another contribution to precision-processing in the aircraft industry by the productive flames of GAS at Solar Aircraft Co., San Diego, California

Solaramic, a new family of ceramic coatings, is used in Solar Aircraft Company's Solaramic pilot plant. The highly refractory materials used to make Solaramic frits are fused in a Gas furnace which maintains carefully controlled temperature to 2500° F.

Applied to jet engine parts, this new coating protects pieces against corrosion and oxidation, instead of acting only as an insulating medium. In addition, this GAS-fired ceramic coating:

- ★ **Reduces hot spots on parts**
- ★ **Minimizes cracking and warping**
- ★ **Increases fatigue life**
- ★ **Improves gall resistance under high-temperature conditions.**

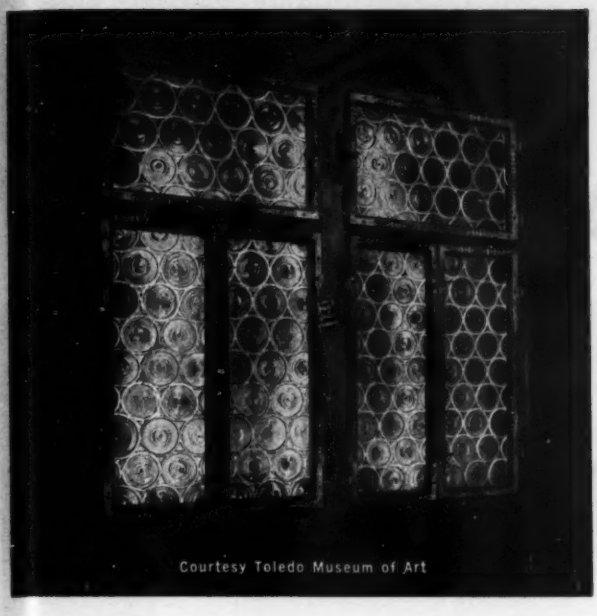
Parts are sprayed with Solaramic and placed in a GAS-fired semi-muffle oven furnace where the temperature is precisely and automatically controlled. Firing temperatures range between 1700 and 2000° F., assuring dependable adherence of the coating to the metal.

The productive Flames of GAS are utilized in this industrial process because GAS:

1. **Allows rapid temperature recovery after charging**
2. **Permits exact control of temperatures, automatically**
3. **Permits easy adjustment of furnace atmosphere as required.**

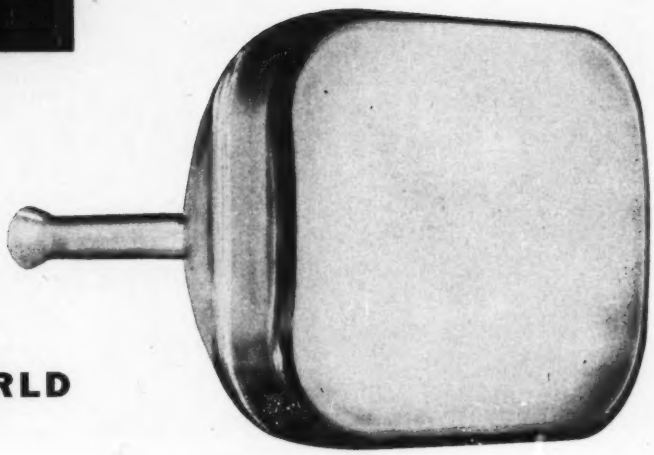
GAS is the modern fuel for all industry, because GAS is versatile in application, clean, and can be automatically controlled to provide exact temperatures required. Modern Industrial Gas Equipment fits production-line techniques. For the facts, see your Gas Company Representative.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK



Courtesy Toledo Museum of Art

MASTERPIECES FOR MILLIONS

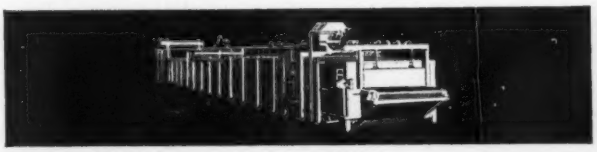


WINDOWS ON THE WORLD

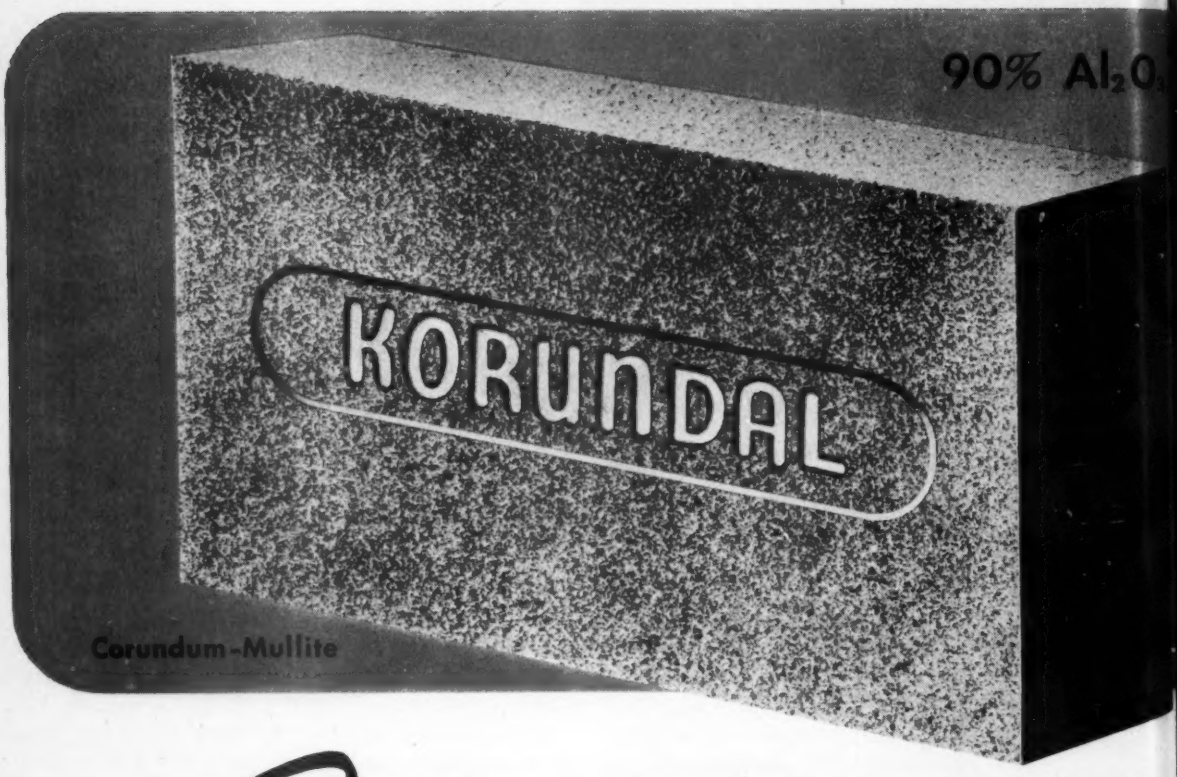
Pictured above is a distinguished example of *"blown glass"* window panes, made by literally whirling glass into discs. Several centuries ago the window looked out over a Swiss landscape. Today its beauty and historical value are preserved in a unique exhibit at the Toledo Museum of Art . . .
Today's art of glassmaking, plus the magic of electronics, bring the whole world into view through special "windows": television tubes of ever-increasing size. Many hands and many minds contribute to the flashing beauty of these wondrous windows. Our part is to provide furnaces which unerringly adhere to the most precise processing specifications.

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

HEAT PROCESSING EQUIPMENT
FOR THE GLASS INDUSTRY



HARBISON-



2 OUTSTANDING REFRACTORIES

Fired and stabilized at extremely high temperatures

®

WALKER

[redacted] is entirely stable at very high temperatures because it consists of the stable minerals corundum and mullite, with the former predominating. Both of these minerals are highly resistant to the strongly corrosive action of alkalies and other fluxes. KORUNDAL does not shrink and is highly resistant to severe spalling conditions. Its advantageous use in vulnerable positions of the superstructure of glass melting furnaces is established by experience.

[redacted] consisting entirely of corundum in the purest form available, is stabilized in manufacture by a soaking heat treatment at over 3000° F. In the presence of alkalies, corundum has even greater stability than mullite, since it cannot decompose to form alkali-silicates of lower refractoriness.

HARBISON-WALKER REFRACTORIES COMPANY
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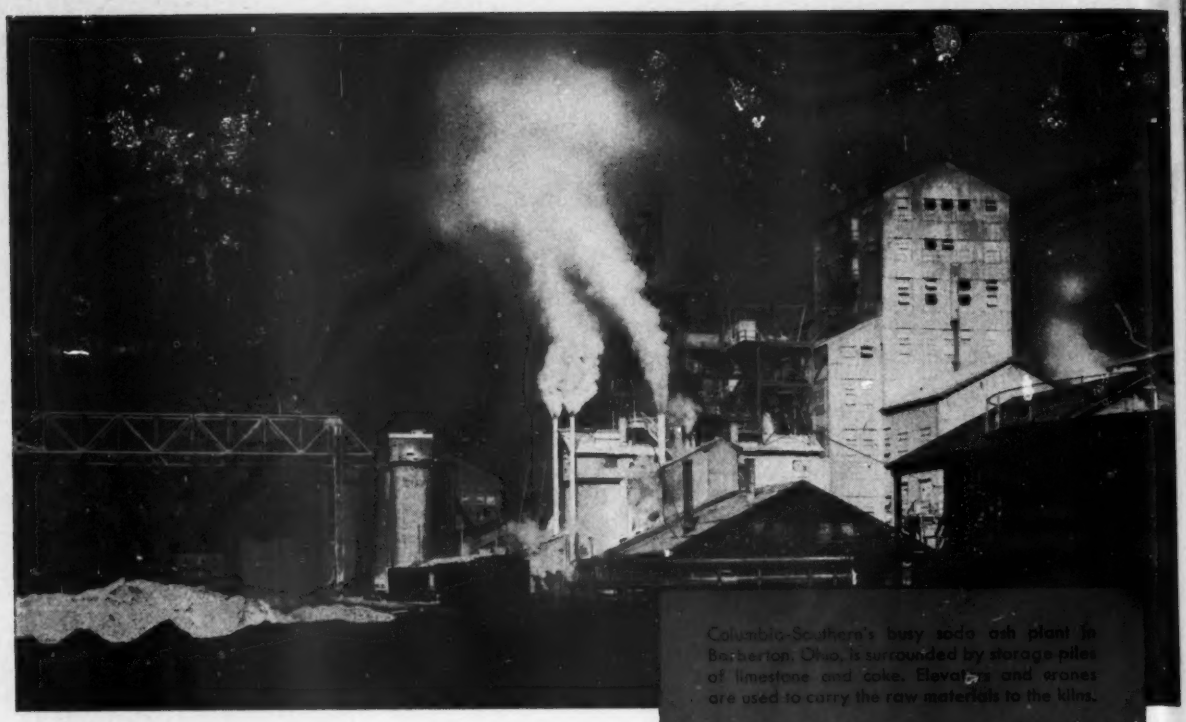

Columbia-Southern's busy soda ash plant in Barberton, Ohio, is surrounded by storage piles of limestone and coke. Elevators and cranes are used to carry the raw materials to the kilns.

Salt is important in manufacturing Columbia-Southern dense soda ash. Water is forced down to the salt beds, and the brine is pumped and stored in tanks like the one shown below.

COLUMBIA-SOUTHERN
DENSE SODA ASH
...the means to Better Glass

For over half a century, Columbia-Southern has been supplying exceptionally high standard soda ash to the glass industry.

Chemical purity, high density, and freedom from dust are factors carefully controlled in the manufacture of Columbia-Southern Dense Soda Ash. A choice of particle sizes assures proper blending with other constituents in the glass batch.

The excellence of this product, coupled with Columbia-Southern's *qualified* technical assistance, is a combination that means better glass.

We welcome the opportunity to serve you and to help you with any of your problems involving soda ash.

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THE GLASS INDUSTRY

VOLUME 34, NUMBER 12, DECEMBER, 1953

HOT COLOR SPEEDS DECORATING AT BROCKWAY

By C. E. DOOLITTLE, DECORATING SUPERINTENDENT
Brockway Glass Company, Inc., Brockway, Pa.

Located in the heart of the Alleghany Mountains in Brockway, Pennsylvania, the Brockway Glass Company, Inc. maintains its home offices and two of the most modern glass container plants in the country. Other Brockway plants are located in Muskogee, Oklahoma, and Lapel, Indiana.

While this article deals primarily with Brockway's decorating operations in Brockway, it should be mentioned that decorating is also carried on at the Muskogee plant. Although this plant is equipped similarly to that of the Brockway plant, with the exception of the automatic machines, it is the headquarters operation that really exemplifies the progressive manufacturing viewpoint of the company.

Brockway Glass started decorating ware at their #2 plant in Brockway in August 1946. Equipment at that time consisted of one Hartford-Empire M D lehr and one two-color decorating line. This Decorating Department—and it has grown to such proportions that it could really be considered a plant in itself—is now equipped with three Hartford lehrs, six semi-automatic decorating lines and one fully automatic machine. All of the decorating equipment was manufactured by the Solar Engineering and Equipment Company.

The semi-automatic machines are all of the electrically-driven type with an automatic registration device attached to most of them enabling the operators to attain high speeds and yet achieve near perfect registration. The fully automatic machine used in this plant is a recent development. It requires an operator, a loader and an inspector.

After the bottles are manually loaded onto the loading conveyor, they are moved on a canvas belt operated by an electric eye onto a short unscrambler belt which passes under a star wheel unscrambler. This device spaces the bottles in a single line on a conveyor belt which then deposits them into a feed-in cradle which loads them into the decorating machine horizontally. The bottles are moved through the machine by 25 cradles on a reciprocating arm.

On the first printing head, there is a pre-registration chuck driven by a clutch arrangement which turns the bottles until a small metal tool comes into contact with the registration dimple on the bottle. At this point, the bottle is stopped in proper relation to final registry directly following the pre-registration chuck. At this station, the bottle is revolved to exact relation to the label on screen. Further revolution of the bottle is made while the screen moves over it.

In the actual application of color to glass, a squeegee rubber forces the color through the open mesh of the decorating screen onto the bottles. In applying the second color, the bottle undergoes identical mechanical progression on the second machine as that which took place in the application of the first color.

When the second printing has been accomplished, the bottles are then uprighted by the take-out cradle (a device to upright the bottles from their horizontal position necessary to the color application) onto a series of endless belts and star wheels which pass bottles in front of the lehr for inspection and lehr loading.

Artists at work in the screen room.

View of front end of a Lehr showing two semi-automatic machines with lehr attendant servicing color container and inspectors loading lehr.

The most recent development in the decorating field is a thermoplastic color, commonly referred to as "hot color". It was to handle this new material that the automatic machine used at Brockway was primarily designed and built.

In the hot color, the dry ceramic powder is milled into a thermoplastic medium at a temperature of approximately 185°F., at which point it is in the form of a fluid. When it has cooled to about 125°F., it becomes set up and is rather brittle. In use the brittle material is then heated in the screen until it flows readily. When it is actually applied to the bottles, which are at room temperature, it again becomes "set up". Due to this rapid setting up on contact with the cool bottle, it is possible to immediately over-print with additional colors.

The Brockway Glass Company was one of the first container manufacturers to successfully use hot color on the production line. Early in this operation, there was close cooperation between Brockway and The O. Hommel Company in the development of a satisfactory method of heating the decorating screens. This same close cooperation was carried on with duPont, Hommel and B. F. Drakenfeld & Company in perfecting colors which would work satisfactorily.

An important segment of Brockway's Decorating Department is a highly efficient screen room occupying an area 22′ x 44′, in which is incorporated a dark room approximately 8′ x 18′. This room houses the latest dark room equipment, such as coating equipment for the photographic screens, drying cabinets and the exposing arc lamp. The room also serves as headquarters for the art staff who design the ACL labels. Screen cleaning and the actual assembly of the wire to the metal frame is done in another part of the Decorating Department.

For salvaging perfectly good bottles on which there has been a misprint, there is a wet washer consisting of a wash tank with many sprays, a pair of power-driven nylon brushes and a rinse tank which sprays the bottles with clean water throughout its entire length.

In addition to obtaining the highly efficient manufacturing equipment and facilities, sustained quality of product is a fundamental policy of Brockway Glass Company. To insure this maintenance of quality, the plant testing department makes a complete check of decorated ware at regularly timed intervals during each twenty-four hour period. The testing procedure includes pressure testing, thermal shock testing and polariscopic examination for annealing strains.

Further evidence of the painstaking effort that goes into maintaining quality and product improvement is the recent adoption of a color resistance test which, it is believed, will provide the most complete check on resistance of colors used against acids and alkalis and at the same time offer a check on the coefficients of expansion

(*Continued on page* 692)

Feeding hot color to fully automatic decorating machine while quality checking is made before bottles enter lehr.

View of front end of department looking across the loading end of all three decorating lehrs.

ELECTRIC ANNEALING AND AUXILIARY HEATING IN THE GLASS INDUSTRY

By DIPL.-ING. J. HOROWITZ
Alten, Switzerland

TRANSLATED BY S. R. SCHOLES

PART II

Types and Construction of Electric Lehrs

The term "cooling oven" (lehr) at first seems to involve a contradiction. We might better speak of a tempering or thermal after-treatment of the glass, which includes a heating as well as a cooling-off period. The expression "cooling" (Engl.: annealing) of the glass has nevertheless become naturalized in the German language.

Two types of electric annealing ovens are distinguished: the chamber oven (kiln) and the continuous lehr. Both kinds are exclusively built as ovens with indirect resistance heating. The most important feature that they possess is the relatively simple means of automatically regulating temperatures, which make it possible to get any desired or necessary temperature-time curve with certainty. The atmosphere is so pure in the electric lehr that the outcoming ware may be regarded as sterilized.

The Kiln Type

The kiln is operated periodically. The ware cools as the kiln cools. After complete cooling, the chamber is emptied and, before the beginning of a new cycle, is brought to the temperature of the charge of entering ware. If the annealing of cold ware is to be done, slow heating-up is necessary. In considering this periodic operation, the heat capacity of the kiln itself comes into the picture. This must be kept as low as possible to avoid heat loss.

The electric kiln finds its chief use in special cases. It is especially valuable when large pieces must be quite slowly cooled, or in circumstances when the factory operation requires frequent interruptions in the use of the kiln. Thus, large rectifier bulbs, after finishing before the blast-lamp, are kiln-annealed. The operation of the electric kiln becomes more economical when the off-peak current is used, as at night.

In the American electric kiln shown in Fig. 11, all the exterior walls are carefully insulated against heat loss.

The type of ware annealed (optical glass, in particular large lenses) requires precise temperature regulation, accomplished by a sensitive voltage regulator, capable of holding the voltage constant within 0.1 volt, corresponding to a variation of only 0.2°C. in temperature. By this means, only the energy in-put to the whole furnace is held constant. For the regulation of separate resistors, closely-graduated rheostats are installed. Large lenses are placed in the oven in the original molds, and warmed slowly at about 2°C. per hour. The iron mold weighs 3000 lb., and the glass content is about 4500 lb. The annealing temperature is held constant for 30 days, and thereafter cooling proceeds at 0.1°C. per hour, a rate that increases after a certain temperature limit has been reached.

Continuous Electric Lehrs

The continuously-operated electric lehr has its principal use in normal, continuous factory production. It is used with success not only for tumblers and containers, but for practically all technical glassware and even for quite delicate optical glass. In the continuous electric lehr, the ware passes through a number of zones, each with its specifically controlled temperature. It finally issues at the sort end, having followed a pre-determined cooling curve.

Vertical electric lehrs are unusual. Fig. 12 shows one such, built in England, with two tubular ovens side-by-side but independent, in which valuable optical glass is annealed. Pressed blanks for lenses constitute the ware. These blanks, of selected optical glass, have been formed from pieces reheated in a muffle furnace and pressed in iron molds. This process gives rise to strains in the glass, which must be eliminated in the lehr. The blanks are immersed in sand in iron boxes, the form of which corresponds to the cross-section of the lehr. At regular time intervals, boxes are put in at the top and removed at the base of the lehr, which is thus kept continuously filled with iron boxes standing one upon another. In this installation, optical glasses of different kinds—crown, flint, borosilicate—with softening points differing as much as 100°C. from each other can be annealed at the same time. The sand in the boxes keeps the blanks from deforming. The oven-canal is divided into several temperature zones. A series of thermocouples distributed over the length of the oven serve for controlling temperatures.

Horizontal Electric Lehrs with Belt Conveyors

Fig. 13a shows the principal features of this construction. The heating elements are connected in groups, each of which is wired to its own automatic temperature regulator. One lehr has in general more groups of resistors than heat zones, so that, according to its purpose, each heat zone has more than one group of resistors. Fig. 13b shows the wiring diagram of a lehr with 4 heat zones and 5 heating elements. (Lehr A in Table II.)

A typical example of this class of lehrs is the machine-lehr of the Simplex Engineering Company (Table II), much used in England and America. In Table II are the technical data for an average Simplex lehr used for annealing containers and similar articles (Lehr A), and in contrast, the dimensions of a large lehr for annealing plate glass in sizes up to 12 x 20 feet. In these lehrs, the heating current is augmented on both sides to equalize heat loss through the walls and thus to get a more uniform heat distribution over the whole breadth of the lehrs. In the middle, the switch-board is shown.

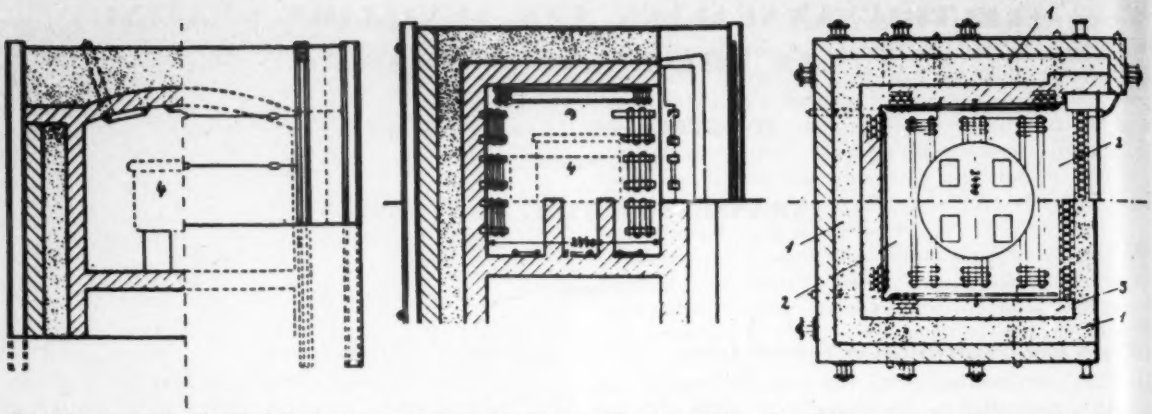


Fig. 11. American electric kiln for large telescope lenses. 1 = Heat insulation, 2 = Kiln space, 3 = Masonry, 4 = Casting form to receive lens.

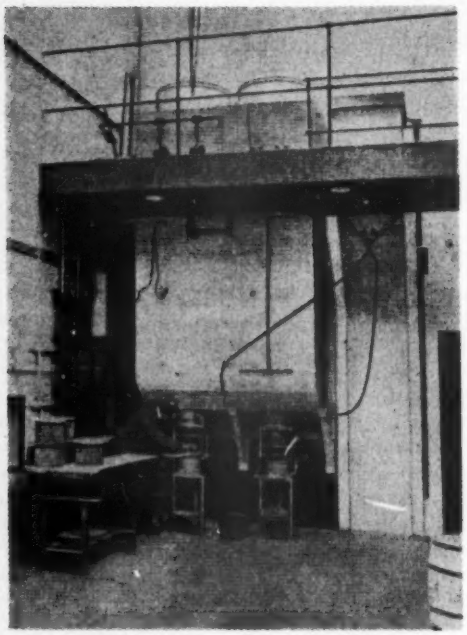


Fig. 12. Two close-built continuous electrical lehrs in vertical, tubular arrangement for annealing optical glass.

TABLE II

Technical Data for the Simplex Eng. Company Electrical Lehr

	Regular Form Type A	*Large Form for Plate Glass Type B*
Length of Lehr	90 ft.	675 ft.
Inside width	4 ft.	13.5 ft.
No. of Heating Zones...	4	12
No. of Groups of Elements	4 to 6	20
Total length of Hot Zone.	——	370 ft.
Lengths of Hot Zones...	Uniform	30 to 37 ft.
Energy required	60-90 Kw.	1600 kw.

The endless conveyor for these lehrs is woven from heat-resisting wires, and weighs about 2 to 4 lbs./ft. Other constructions employ plates hooked together in a chain or a traveling grate made of plates. The endless conveyor acts as a heat carrier which continuously moves from the high-temperature zone to the exit-end, where it reaches room temperature. In order to keep the resulting heat loss to a minimum, the bands are carried back inside the lehr for pre-heating. Recuperation is thus obtained and besides, additional hot bodies are used mostly in the form of a hot-drum over which the band is led.

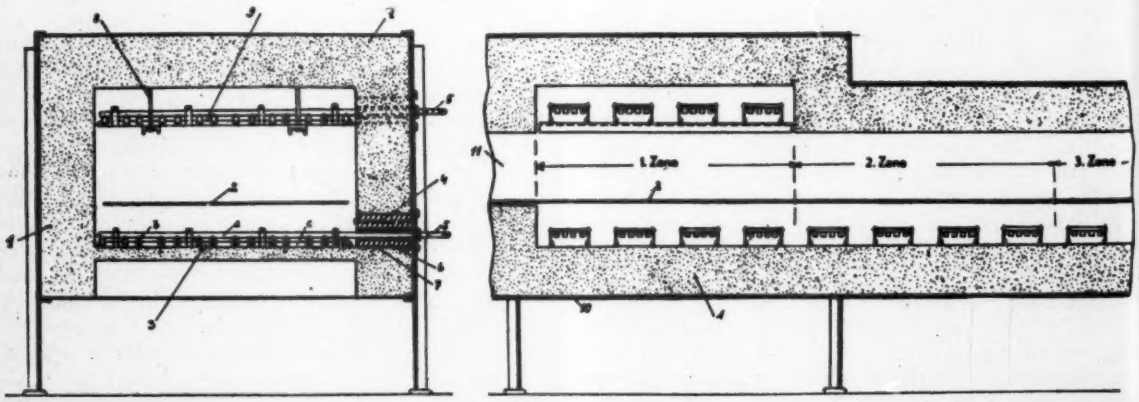


Fig. 13a. Principal structural detail of a continuous horizontal lehr with conveyor.

Horizontal Electric Lehrs with Step Conveyors

Continuous conveyors give rise to great heat losses, which can be obviated by using step conveyors or pendulum grates, as in many installations. Figures 14 and 15 show how these operate. The glass article moved forward by the grate-bar A is taken over after a short stroke by grate-bar B, since not only is the driving eccentric of one grate-system set at 180° to the other system, but also the eccentric C is offset to the eccentric D by a phase-angle, γ. The eccentricity F of the driving disk D is generally 6 to 8 times that of the value E for the driving disk C. The path that the article takes at each step has, therefore, the form of an elongated, small half-ellipse (see Fig. 15). The effective length of the step, L, is found by:

$$L = A \cdot \cos\gamma = 2\,F\cos\gamma$$

The driving mechanism is so built that forward movement is controlled by varying the phase-angle γ, as well as by regulating the speed of the driving motor.

(Illustrations of operating lehrs are shown. The step-conveyor lehrs save 20 to 25% in electrical energy as compared with the belt-conveyor type.)

Efficiency of Electric Lehrs

Conditions for Efficiency. It is the same for electric lehrs as for all industrial furnaces: a real efficiency exists only if the operating costs, at a maximum price for electrical energy, are not higher than they are with fuel-firing. (The author presents an elaborate formula for comparing cost of electrical operation with fuel-firing, producer-gas or oil. He maintains that the saving in loss and breakage and badly annealed ware brings in a factor that allows for a high cost of energy.)

Energy Requirement for the Electric Lehr. For kilns, this general equation of the electric furnace is valid. This expression merely says that the total energy required is equal to the energy lost in the kiln, plus that required to heat the load of ware. In the continuous lehr, the incoming ware is hot enough to contribute heat to the lehr, and this addition helps to bring down, substantially, the requirement of electrical energy.

Comparative Data

Current consumption by continuous lehrs is dependent in the broadest sense upon the efficiency of the installation. The operating results for the lehrs described present the results obtained in practice and can serve as bases for comparison. Lehr breakage has a strong influence on the cost of annealing. In this connection, the electric lehr offers a great advantage because the close temperature regulation permits perfectly safe annealing. In many instances, the savings resulting from reduced lehr breakage far outweigh all unusual operating costs. However, this factor is difficult to evaluate in comparative reckoning. Also, the height of installation costs and the allowance for depreciation are so very different according to the size, elaborateness and operation of the lehr that generally satisfactory comparison figures cannot be worked out. The calculation of efficiency must be separately made for each single case, taking all conditions into consideration.

Auxiliary Furnaces

Tempering Furnaces. In plate glass and hollow-ware

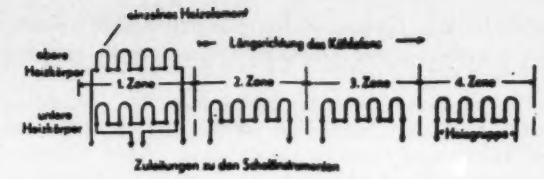


Fig. 13b. Typical wiring diagram of an electric lehr, showing heating elements in groups.

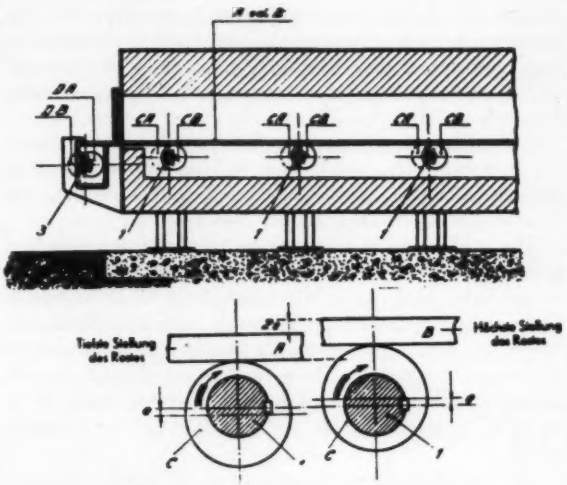


Fig. 14. Operation of step-conveyor or pendulum grate.

factories and the like operating with pots, the fireclay pots must undergo a drying, firing and pre-heating process before they can be set in the furnace. This so-called "tempering" operation is also of use in tank-furnace practice for preheating rings, floaters, bridges, etc., as well as the debiteuses for Fourcault drawing machines. The object of this ceramic firing process is to give the pieces the required solidity and resistance.

After forming, the raw pots and other pieces first undergo a long drying in a ventilated room, so that the clay contains only a minimum of moisture when it enters the tempering furnace. This free water is driven off by slow heating up to about 120°C. On further heating, chemically-bound water begins to come off at 450°C. and here, in electric furnaces, a slight up-draft is provided. This evolution of water of crystallization takes place at first slowly, then faster at 600°C. and it is complete at 700 to 800°C. An extremely important change in the clay takes place with the loss of water. It has forever lost its plasticity and is now burnt clay. On con-

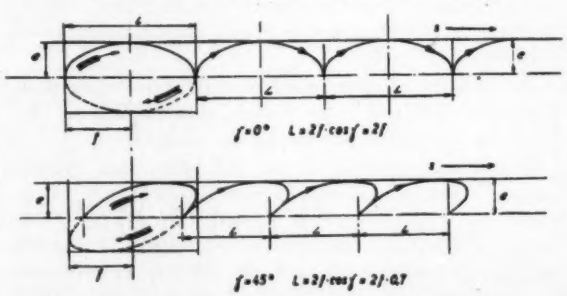


Fig. 15. Schematic representation of Fig. 14.

tinued heating, further solidification takes place, and the mass shrinks, losing porosity and eventually reaching final density.

The necessary maturing temperature lies, according to the kind and composition of the clay, between 960 and 1450°C.

In fuel-fired pot arches, the pre-heating requires 80 to 100 hours. The temperature can be raised only slowly, because unequal heating may crack the pot. At a maximum temperature of 900 to 1000°C., the pre-heating is ended. The firing of one ton of clay required 0.3 to 0.5 ton of coal. Under unfavorable conditions, high maturing temperature and long tempering time, as much as 8 million K-cal. (32M cu. ft. of natural gas) may be needed for each ton of clay.

Pots usually have irregular dimensions, bottoms being much thicker than sides, thus making uniform heating difficult. For plate glass, for example, pots may hold 2.5 tons of glass and weigh, empty, two tons.

The application of electrical heat to the tempering furnaces worked out very well. Firing time was reduced by 40 per cent; that is, for large pots, from 85 to 53 hours. The energy required was 835 kw. hr. per ton. Breakage, which ran 4 to 5 per cent with fuel-firing, was absent in the electric operation. These furnaces were made in two forms, chamber ovens and hood ovens, and used 60 to 76 KW in sizes suitable for a single pot or a single debiteuse.

All these tempering furnaces were equipped with temperature regulation and program control. With chromium-nickel resistors, temperatures of 1000 to 1100°C. could be reached. The pieces to be fired were set up on blocks to obtain adequate heating of under surfaces.

Electric Decorating Kilns

Electricity was used with excellent results for fired-on decorations and colors. The usual enamels were used, applied by brush. Temperatures ranged from 500 to 600°C. Annealing followed. Close temperature control was necessary to get uniform color effects.

Not only did the electric kiln work without breakage loss, but the time of the process was materially shortened. No muffle was necessary because the atmosphere of the kiln was always neutral and clean. The energy needed was about 1 Kw. hr./Kg. of glassware.

Recently, continuous electric decorating lehrs have been built, leading to high production. These resembled the electric lehrs previously described.

Electric Furnaces for Re-working Glass

In factories where glass is re-worked, electric furnaces are often used, especially where precise control of temperature or the temperature curve is essential. Also, when glass articles must have careful cooling after re-heating to avoid the incidence of strain, the same problems arise as in the original annealing. Therefore, kilns become essential and are used in rectifier- and electronic-glassware plants.

In the production of safety glass, two procedures are distinguished: (1) Hard glass, Sekuritglas or tempered glass, is brought to a predetermined and desired degree of strain by heating and then plunging the sheet or plate into a bath. It then becomes highly resistant to stresses or shocks. The certainty and uniformity of temperature necessary for the toughening process can be obtained only in an electric furnace. (2) Sandwich glass, Triplex variety, is made by bedding an elastic layer of special material between two plates of glass. Extremely uniform heating is required to develop the transparent plastic film between the plates. The best results are accordingly obtained with electrical heating.

Electric furnaces are used for numerous purposes in the optical glass industry. In the making of pressed blanks for spectacle lenses, condenser lenses and the like, preheating before pressing, as well as the subsequent annealing, are best accomplished in an electric oven, one for each operation. For bifocal spectacle lenses, a glass for near-vision is welded to a previously ground and polished lens. This operation is particularly critical because the occurrence of small bubbles in the weld must be scrupulously avoided, in order that the final double lens may seem to consist of a single piece of glass. For this operation, also, the electric furnace is almost exclusively used.

REFERENCES

1. Glass Industry, 1953, pp. 65-251.
2. Adams and Williamson: Jour. Franklin Inst., *190*, p. 597 and p. 835.
3. Gehlhoff and Thomas (German journal).
4. Jour. Opt. Soc. of Amer., Vol. 4, p. 224.
5. The Annealing of Glass, J. Soc. Glass Tech., 1917, p. 61.

A.C.S. SECTION ACTIVITIES

The Pittsburgh Section of the American Ceramic Society held its Ladies Nite on December 4, with Frank Jansma as Chairman of the Entertainment Committee. On the program for the evening was square dancing, door prizes and a midnight buffet.

The January meeting of the Section will feature R. R. Danielson, President of the Society, who will talk on "Applications of Opacifiers in Glazes and Enamels."

At a recent meeting of the Northern Ohio Section, George C. Deutsch, Assistant Section Head of the N.A.C.A., talked on "Cermets—a new product for industry." Mr. Deutsch's illustrated talk covered the history of cermets, the extent of cermet research, the various ways cermets are fabricated, the high and low temperature strength properties and industrial uses. In January, the Section will present a TV program covering the activities of the ceramic engineer.

The Philadelphia Section of the Society, at a recent meeting, featured an informative talk on the "Properties and Uses of Glass Fibers and Fibrous Glass Materials" by Dr. A. W. Davison, former Director of Research for Owens-Corning Fiberglas Corporation and now consultant for that company. A later meeting featured John F. E. Hippel, a well-known Philadelphia attorney, who spoke on "Labor-Management Relations in Iudustry."

• Thatcher Glass Manufacturing Company, Inc. has announced the appointment of David J. Yaeger as Purchasing Agent.

• J. S. Fawcett has been named Director of Fisher Scientific Company's Development Laboratories. For the past two years he has headed the company's Fisher-Tag Division.

PLANT LAYOUT AND DESIGN — SUMMARY OF A GLASS CONFERENCE PAPER

Plant Layout and Design

By Roy S. Arrandale

Thatcher Glass Mfg. Company, Elmira, New York

Editor's Note: Much of this paper deals with a mathematical presentation of the thermodynamics of fluid flow. For condensation, this part has been omitted. Likewise, the original paper contains charts covering every conceivable situation. A selected few of these have been reproduced, which are a representative cross-section covering the bulk of possible situations that may arise.

One of the biggest holes in the arsenal of tools which the design engineer has at his disposal, and particularly the glasshouse engineer, lies in the determination of pipe sizes that go into a plant. A glass plant runs on its "utilities." In a glass forming plant, for example, compressed air is the heart of the operation.

Because the fundamental rational relationships are not generally understood, most engineers resort to irrational formulas for pipe size which have been developed for a specific purpose, or more often carried down through years and years of previous handbooks. Some employ a general range of fluid velocities, or pro-rate from a preceding design or just guess. The general result may be good upon the part of an experienced person, but the result of improper sizing can be either starved operation of the equipment and/or a tremendous waste of money in the form of pipe that is way oversize. The general tendency is to think that all valves and fittings regardless of purpose have to be the same size as the pipe itself, which in many cases get very expensive. The pipe then "carries on its back," so to speak, an overloaded investment all around the plant. Also there is the matter of obsolescence of piping installations because, of necessity, changes must be made with the passing of time in furnaces, machines, etc.

A certain amount of discretion or experience is necessary also before one recognizes the importance of providing for future expansion. By ready intuition one can enlarge a section here, a section there and have the system able to handle an extension to its capacity without much difficulty, or a least with a minimum removal of piping.

Most of the well-known handbooks carry an assortment of formulas from one to another all through the years. In many cases no discrimination is made and several formulas, and sometimes very complex graphs or alignment charts, are presented for the same thing. Usually no common nomenclature is employed and sometimes the same formula does not hold over a complete range of pipe sizes, in which case two are necessary. The tendency is to over-generalize the charts and to complicate the charts to the extent that to avoid eye strain it is simpler to use the formulas themselves.

In the equipment manufacturers' handbooks, the tendency is to present tables at one arbitrarily selected pressure or temperature and other tables for conversion factors.

In handbooks, such as Perry's "Chemical Engineers

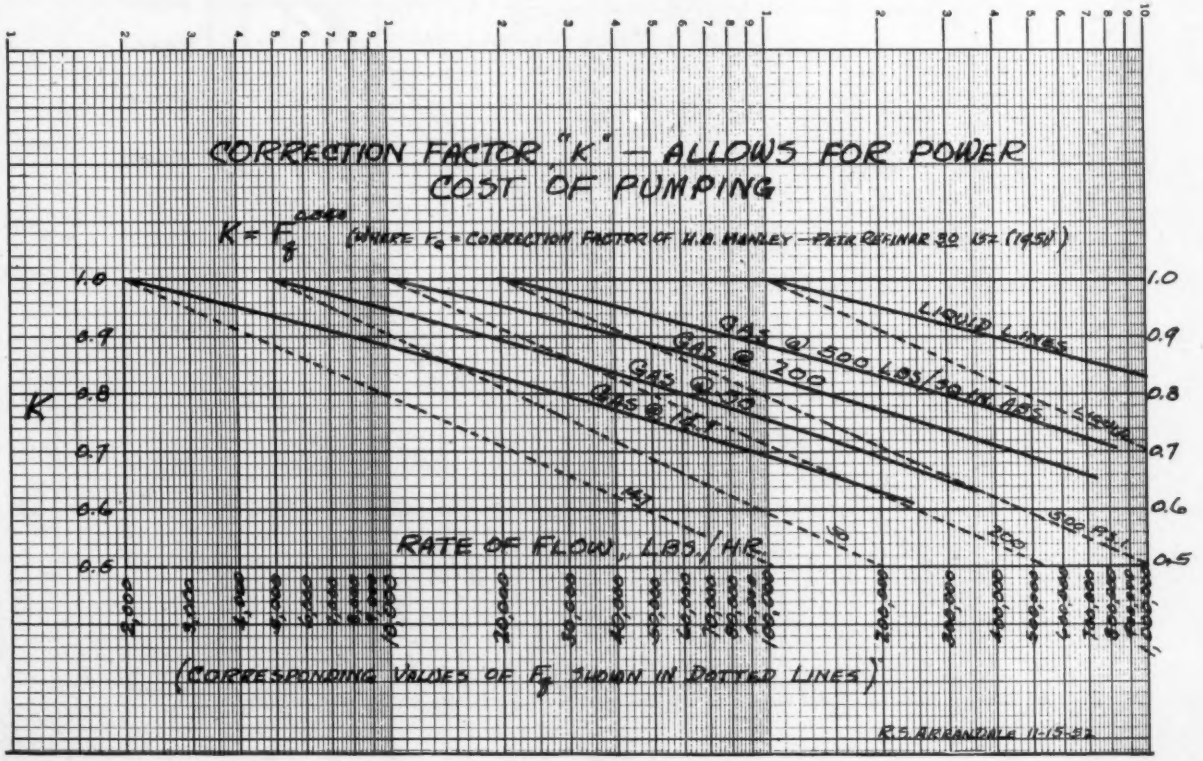
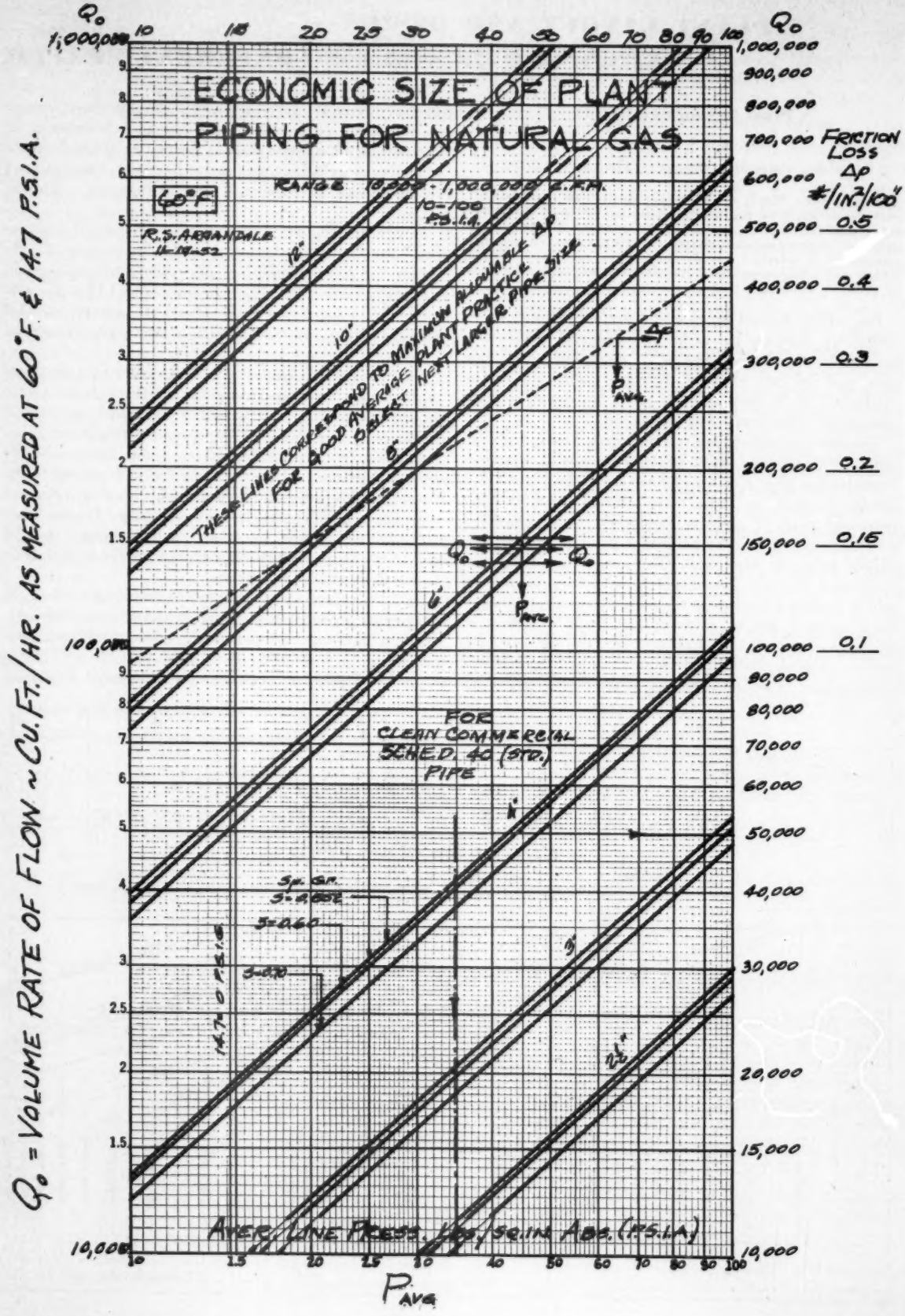


Fig. 1.


ECONOMIC SIZE OF PLANT PIPING FOR NATURAL GAS
60°F
RANGE 10,000 - 1,000,000 C.F.H.
10-100 P.S.I.A.
R.S. ARRAMPALE 11-19-52
THESE LINES CORRESPOND TO MAXIMUM ALLOWABLE ΔP FOR GOOD AVERAGE PLANT PRACTICE & GIVE NEXT LARGER PIPE SIZE
FOR CLEAN COMMERCIAL SCHED. 40 (STD.) PIPE
Sp. Gr. S=1.00 S=0.60 S=0.30
14.7 P.S.I.A.
Q₀ = VOLUME RATE OF FLOW ~ CU. FT./HR. AS MEASURED AT 60°F & 14.7 P.S.I.A.
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P AVG
FRICTION LOSS Δp #/IN.²/100'
Q₀ 1,000,000 900,000 800,000 700,000 600,000 500,000 400,000 300,000 200,000 150,000 100,000 90,000 80,000 70,000 60,000 50,000 40,000 30,000 20,000 15,000 10,000
0.5 0.4 0.3 0.2 0.15 0.1
10 15 20 25 30 40 50 60 70 80 90 100

Fig. 2.

Handbook," the tendency is to the other extreme; viz., over-emphasis in fine print of the theoretical aspects of the generalized rational formulas concerning fluid flow. What charts that are presented are too generalized and too hard to read to be of great value. It is simpler to resort to the algebraic solution of the overly-generalized rational formulas, if one can find the data he needs to put in it.

If the engineer manages to find $<p$, the frictional pressure drop, it is not too sure that he knows what to do with it—whether it is too high a value or too low, and how it relates to the other energy terms in the system. At any rate, it is certain that he would devote many, many hours to the job.

In other words, there is little or nothing heretofore available for the specific fluids that the glass industry employs that would enable one to "turn the crank," so to speak, and grind out the design of complete piping or duct work in the new plant. In this paper, it is hoped to clarify some of the fundamentals concerned in fluid flow and, from the application point of view, to present charts which the writer has worked up for the quick and easy selection of pipe sizes for the fluids that are encountered in the glass plant. These charts cut down to a few minutes that which would require hours of time otherwise and are all similar and as simple as possible, making it almost impossible to read them incorrectly.

All those for gas, steam and compressed air are plotted as volume rate of flow vs. line pressure, giving the pipeline size direct under the specific condition of maximum permissible frictional pressure drop Δp for any point that you might select. It is recommended in all cases that the next size larger pipe be employed for good practice. However, all of these charts are conservative, you will find, and not too much harm will result from selection of pipe size the same as the designated line on the chart indicates without resort to the "next larger."

Each diagonal line represents an identified pipe size for which the rate of flow has been computed from a variable pressure drop of Δp, varying in accordance with line pressure as shown in the equations for Δp represented in Fig. 7 and the flow equations contained in this text.

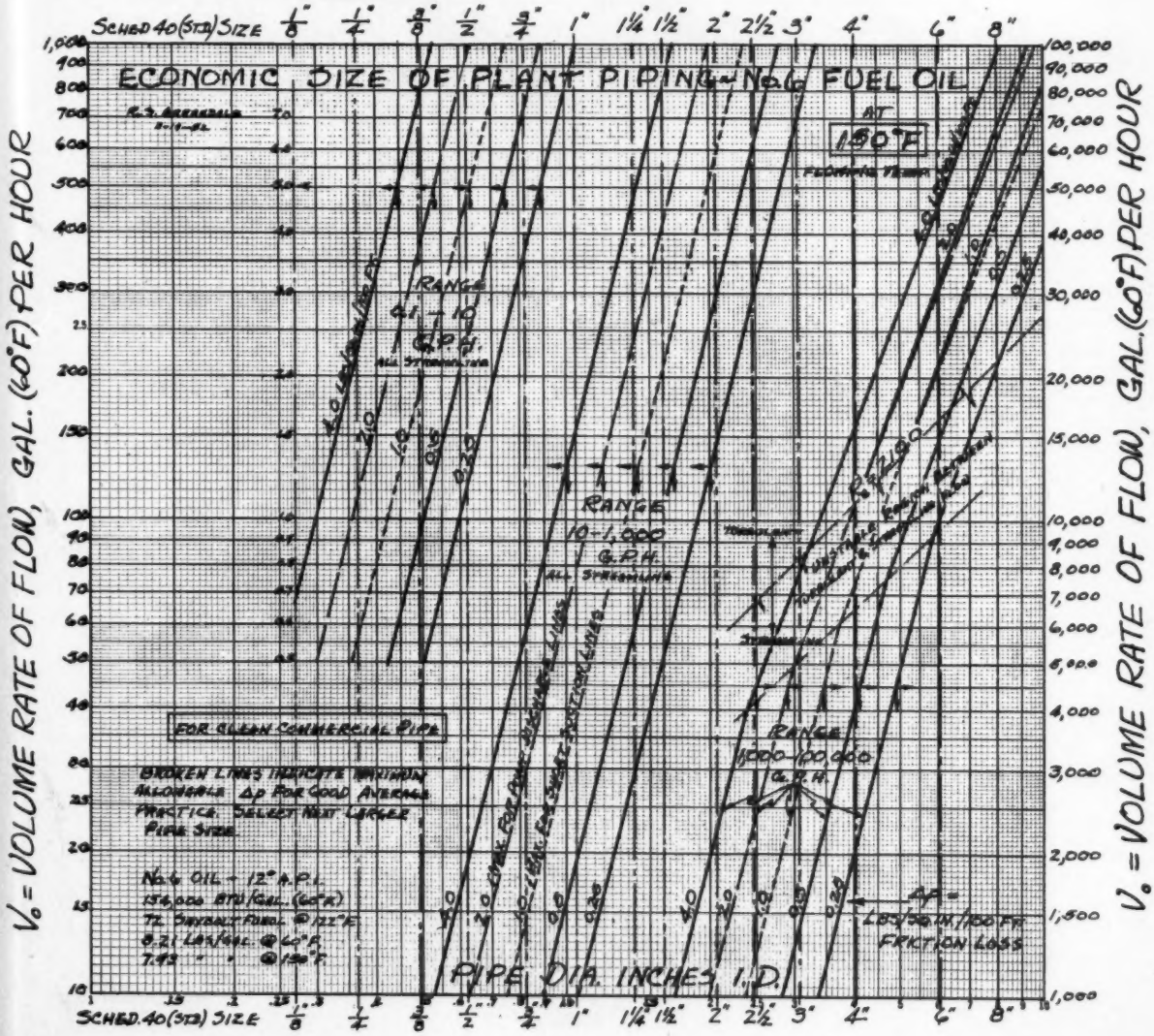

ECONOMIC SIZE OF PLANT PIPING—No. 6 FUEL OIL
AT 150°F
SCHED 40 (STD) SIZE
PIPE DIA. INCHES I.D.
V_o = VOLUME RATE OF FLOW, GAL. (60°F) PER HOUR
RANGE 4 - 10 G.P.H.
RANGE 10 - 1,000 G.P.H.
RANGE 1000 - 100,000 G.P.H.
FOR CLEAN COMMERCIAL PIPE
BROKEN LINES INDICATE MAXIMUM ALLOWABLE Δp FOR GOOD AVERAGE PRACTICE. SELECT NEXT LARGER PIPE SIZE
No. 6 OIL - 12° A.P.I.
156,000 BTU/GAL. (60°F)
TYP. SPECIFIC FUEL @ 122°F
8.21 LBS/GAL @ 60°F
7.93 " " @ 150°F
Δp = LBS/SQ.IN./100 FT. FRICTION LOSS

Fig. 3.

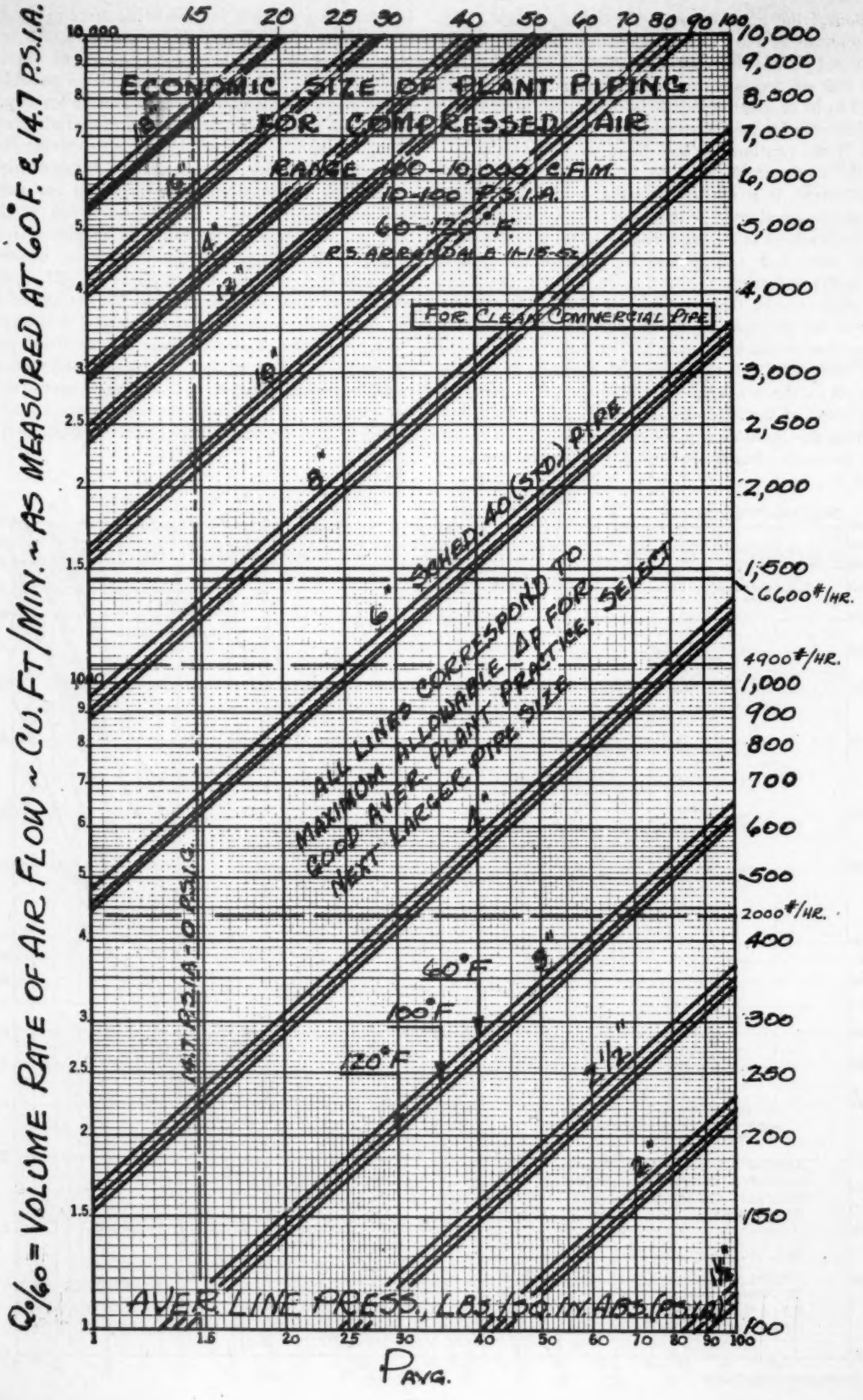

ECONOMIC SIZE OF PLANT PIPING FOR COMPRESSED AIR
RANGE 100-10,000 C.F.M.
10-100 P.S.I.A.
60-120° F.
R.S. ARBAUGH 8-11-15-52
FOR CLEAN COMMERCIAL PIPE
ALL LINES CORRESPOND TO MAXIMUM ALLOWABLE ΔP FOR GOOD AVER. PLANT PRACTICE. SELECT NEXT LARGER PIPE SIZE
SCHED. 40 (STD.) PIPE
14.7 P.S.I.A. = 0 P.S.I.G.
60°F
100°F
120°F
6600#/HR.
4900#/HR.
2000#/HR.
Q/60 = VOLUME RATE OF AIR FLOW ~ CU. FT/MIN. ~ AS MEASURED AT 60° F. & 14.7 P.S.I.A.
AVER. LINE PRESS., LBS./SQ. IN. ABS. (P AVG.)
P AVG.

Fig. 4.

For larger quantities of flow (6" I. D. or greater) the diagonal lines become tilted slightly because of the correction factor Fq (Fig. 1) applied to Δp to take care of power cost of pumping.

In the case of natural gas, the factor Fq has been set at 1.0 all the way through for all quantities inasmuch as natural gas is rarely if ever compressed within the confines of a glass plant, and the power consumption due to Δp is the gas supplier's problem, so long as the incoming pressure is adequate for your needs. For natural gas, the maximum frictional pressure drop allowed, and the same used for the computation of the diagonal pipe size

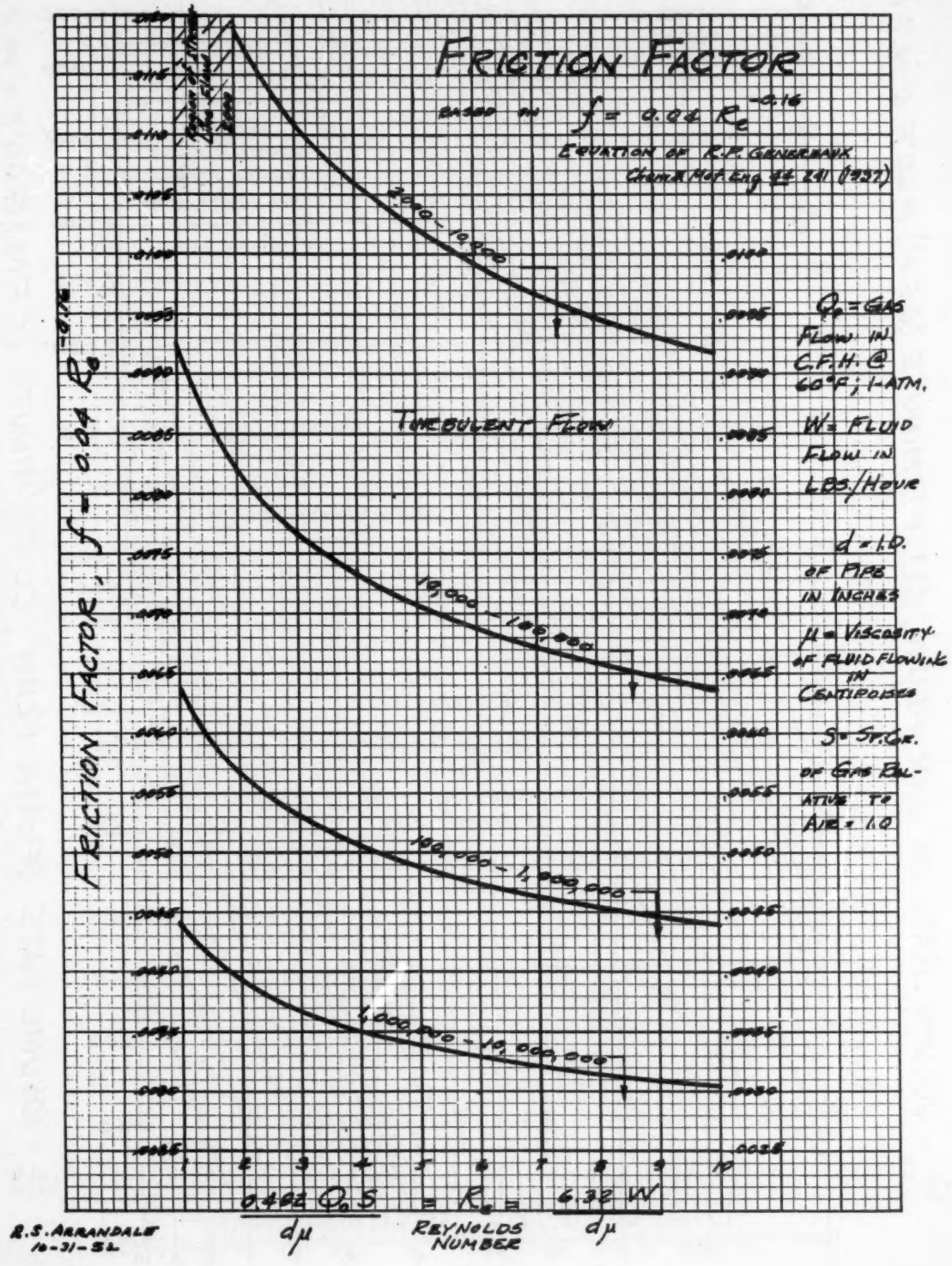

FRICTION FACTOR
BASED ON $f = 0.08\ R_e^{-0.16}$
EQUATION OF R.P. GENEREAUX
Trans. A.S.M.E. Eng. 44 241 (1937)
2000 - 10,000
TURBULENT FLOW
10,000 - 100,000
100,000 - 1,000,000
1,000,000 - 10,000,000
Q_o = GAS FLOW IN C.F.H. @ 60°F; 1-ATM.
W = FLUID FLOW IN LBS./HOUR
d = I.D. OF PIPE IN INCHES
μ = VISCOSITY OF FLUID FLOWING IN CENTIPOISES
S = SP. GR. OF GAS RELATIVE TO AIR = 1.0
FRICTION FACTOR, $f = 0.04\ R_e^{-0.16}$
$\frac{0.482\ Q_o S}{d\mu} = R_e = \frac{6.32\ W}{d\mu}$
REYNOLDS NUMBER
R.S. ARRANDALE 10-31-52

Fig. 5.

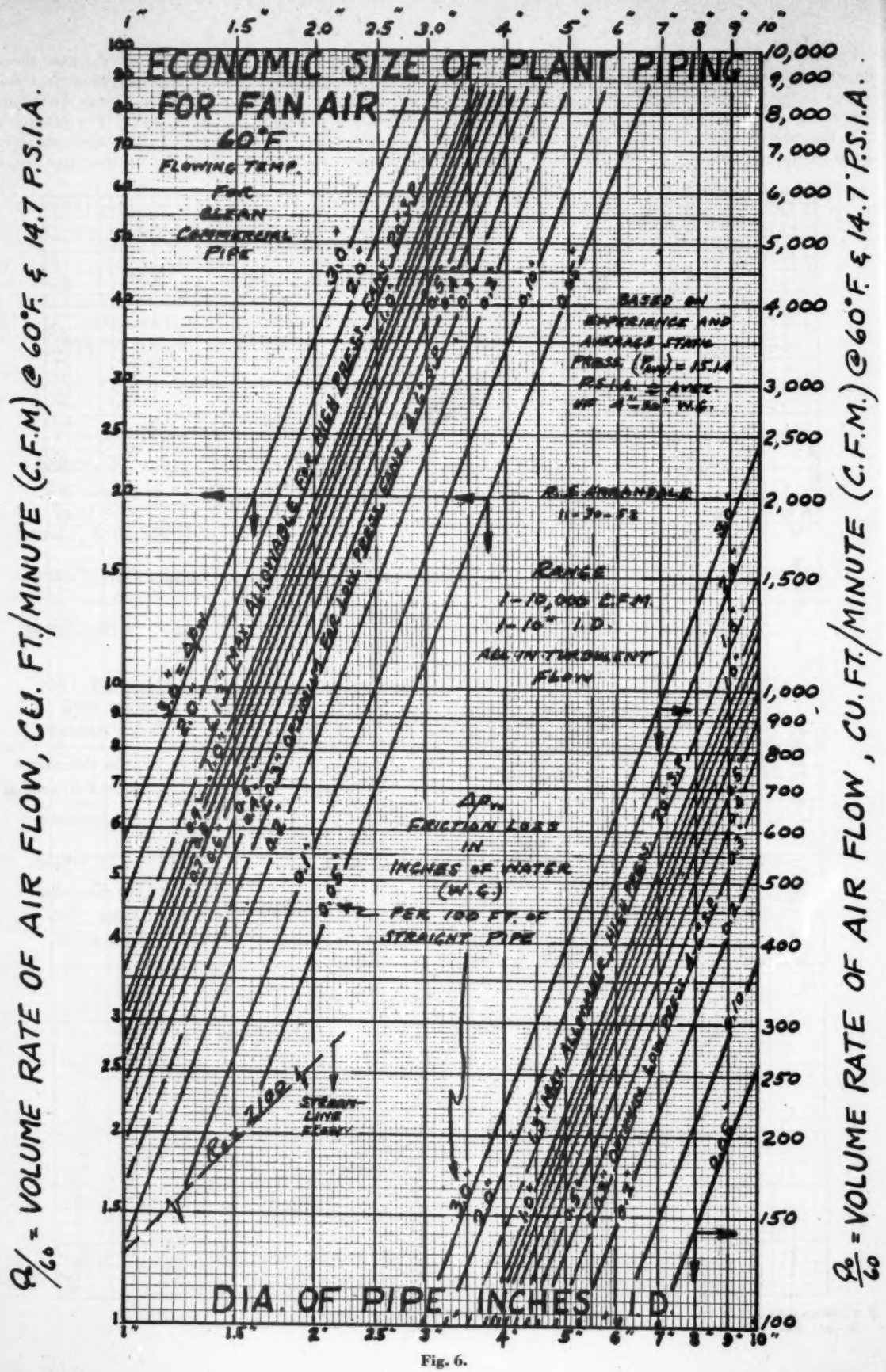

ECONOMIC SIZE OF PLANT PIPING
FOR FAN AIR
60°F
FLOWING TEMP.
FOR
CLEAN
COMMERCIAL
PIPE
BASED ON
EXPERIENCE AND
AVERAGE STATIC
PRESS. (P_avg) = 15.14
P.S.I.A. = AVGE.
OF 4"-30" W.G.
R. E. ARMANDALE
11-30-52
RANGE
1-10,000 C.F.M.
1-10" I.D.
ALL IN TURBULENT
FLOW
ΔP_w
FRICTION LOSS
IN
INCHES OF WATER
(W.G.)
PER 100 FT. OF
STRAIGHT PIPE
STREAM-
LINE
FLOW
DIA. OF PIPE, INCHES I.D.
Q/60 = VOLUME RATE OF AIR FLOW, CU. FT./MINUTE (C.F.M.) @ 60°F & 14.7 P.S.I.A.
Q/60 = VOLUME RATE OF AIR FLOW, CU. FT./MINUTE (C.F.M.) @ 60°F & 14.7 P.S.I.A.

Fig. 6.

lines, is readable directly from the flow chart in accordance with the line pressure and the faint diagonal dotted line as shown for Δp.

To find the actual Δp quickly, the following example is given:

(*Continued on page* 686)

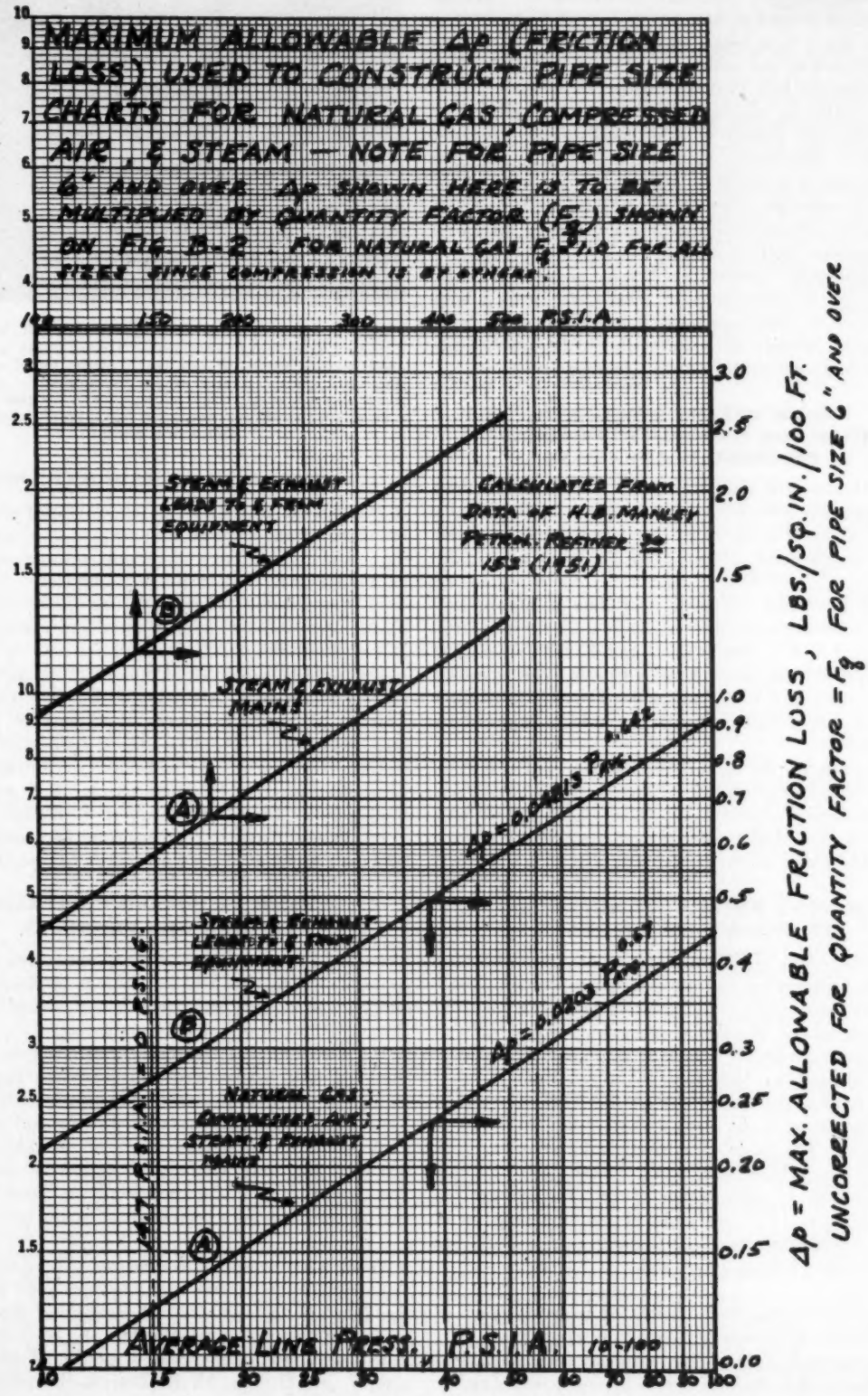

MAXIMUM ALLOWABLE Δp (FRICTION LOSS) USED TO CONSTRUCT PIPE SIZE CHARTS FOR NATURAL GAS, COMPRESSED AIR, & STEAM — NOTE FOR PIPE SIZE 6" AND OVER Δp SHOWN HERE IS TO BE MULTIPLIED BY QUANTITY FACTOR (F_q) SHOWN ON FIG. B-2. FOR NATURAL GAS F_q = 1.0 FOR ALL SIZES SINCE COMPRESSION IS BY ATMOS.
STEAM & EXHAUST LINES TO & FROM EQUIPMENT
CALCULATED FROM DATA OF H.B. MANLEY PETROL. ENGINEER 24 152 (1951)
STEAM & EXHAUST MAINS
NATURAL GAS, COMPRESSED AIR, STEAM & EXHAUST MAINS
AVERAGE LINE PRESS. P.S.I.A. 10-100
Δp = MAX. ALLOWABLE FRICTION LOSS, LBS./SQ.IN./100 FT. UNCORRECTED FOR QUANTITY FACTOR = F_q FOR PIPE SIZE 6" AND OVER

Fig. 7.

THATCHER GLASS TO BUILD NEW CALIFORNIA FACTORY

Franklin B. Pollock, President of Thatcher Glass Manufacturing Company, Inc., has announced the purchase of 18 acres of land at Saugus, California, to be used as the site for a new bottle making factory. The Saugus plant, located on the outskirts of the city of Los Angeles, will become the fifth Thatcher factory.

The California unit, scheduled to go into production during the first quarter of 1954, marks another big step forward in Thatcher's steady expansion program. The Saugus plant is designed to begin operations on an 80-ton per day production schedule, offering employment to approximately 125 persons, expanding gradually until over 200 employees will be needed.

The new plant's operation will make possible the introduction of Thatcher bottles to West Coast users, among whom will be Anheuser-Busch's new 25-million dollar Los Angeles brewery, through the Robert Baskowitz Company of St. Louis, manufacturer's representative.

L-O-F OFFERS STOCK AND CASH FOR NAMING TWIN-GROUND POLISHED PLATE GLASS

Libbey-Owens-Ford Glass Company is offering common stock and cash awards totaling in excess of $8,000 to a selected group of professionals in a competition to name its new twin-ground polished plate glass, it has been announced.

James M. Ashley, Director of Public Relations, said that the contest awards will consist of a first prize of 100 shares of L-O-F common stock and $1,000 in cash to help defray income taxes; a second prize of 50 shares of common stock and $500; and a third prize of 25 shares and $250. The stock is valued at about $38 a share on the open market.

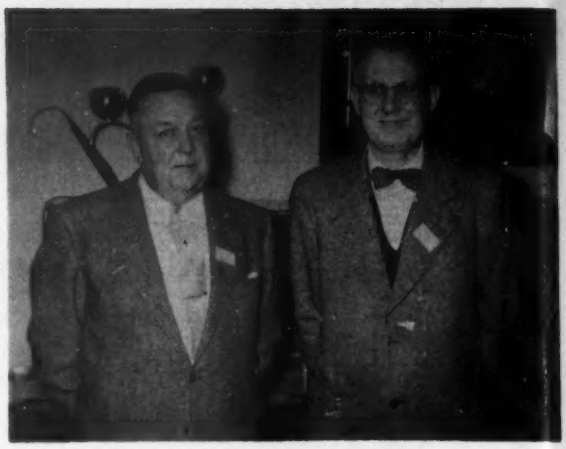
In announcing the contest, Mr. Ashley said that competition was being limited to architects, interior decorators, designers, mirror manufacturers, plate glass wholesalers and their dealers, department store room stylists, and furniture and mirror buyers.

SAFETY RECORD ESTABLISHED AT OWENS-CORNING PLANT

The Santa Clara, California, plant of Owens-Corning Fiberglas Corporation had the best safety record in 1952-53 of any major plant manufacturing mineral wool products in the nation. Harold Boeschenstein, company President, presented a bronze plaque marking this achievement to P. L. Welsh, Plant Manager.

The award is made annually by the National Mineral Wool Association to the plant with the least time lost due to accidents. The Santa Clara plant had a record of 2.97 accidents per million man hours worked in Group One which includes 12 other major plants. The average for this group was 11.67 accidents per million man hours worked and the average for the industry was 12.98 for the period June 1952 to June 1953.

• F. N. Peregoy has been appointed Superintendent of Hazel-Atlas Glass Company's Zanesville Plant No. 2. Mr. Peregoy succeeds E. S. Greer, who has been appointed Production Standards Manager in the company's Quality Control Division.



Franz G. Schwalbe and Charles W. Batchell, hosts at the Toledo Engineering Company's "Oyster Party". The event again took place at Woods Inn, Toledo, Ohio, where more than 200 glassmen and others assembled to enjoy Baltimore oysters, steak, fried chicken, etc., at this annual informal get-together where good food, good drink and good fellowship prevail.

SYMPOSIUM ON RADIOCERAMICS

A symposium devoted to the effect of radiations on ceramic materials, nucleau applications of them and also the use of radioisotopes in ceramic research will be held on January 13, 1954 at Rutgers University, New Brunswick, New Jersey. The Symposium will be co-sponsored by the Ceramic Association of New Jersey and the School of Ceramics, Rutgers University.

Papers to be presented of interest to the glass industry are "Fundamental Approaches to the Glassy State Through Radioactive Tracers," by Henry H. Blau, Ohio State University; "Applications of Radioactive Isotopes to Glass Technology," by S. Frank Cox, Pittsburgh Plate Glass Company; and "Some Effects of X and Gamma Radiation in Glass," by Norbert J. Kreidl, Bausch & Lomb Optical Company. Symposium Chairman is Dr. J. Vincent Fitzgerald of the University's School of Ceramics.

AMERICAN POTASH INCREASES LITHIUM ORE PRODUCTS

American Potash & Chemical Corporation has broadened its activities in the field of lithium products with the offering of lithium ores from a new source in Africa, President Peter Colefax has announced.

The company has completed arrangements to handle lepidolite and petalite ore mined from a large deposit of high-grade lithium-bearing minerals located near Fort Victoria, Southern Rhodesia. Lepidolite and petalite are used primarily by manufacturers of specialty glass and ceramics, but have many other industrial applications. The demand for lithium products has been increasing sharply and they have been in short supply for some time.

• Frank Christenson of Refractory & Insulation Corporation was recently re-elected President and Chairman of the Board of the Industrial Mineral Fiber Institute, Inc. at its Thirteenth Annual Meeting. R. W. Capaul, Glass Fibers, Inc., was elected Vice President of the Institute, and W. M. Ehrlich, M. H. Detrick Company, was reappointed Treasurer.

Inventions and Inventors

Glass Compositions

Copper Ruby Glass. Patent No. 2,653,419. Filed June 16, 1949. Issued September 29, 1953. No sheets of drawings. Assigned to Anchor Hocking Glass Corporation by Ralph E. Brenner and Paul D. Dilliard.

A method of making annealed copper ruby glass is revealed. The annealing of glass of the compositions given in patents numbered 2,174,554 and 2,333,343, dated October 3, 1939 and February 25, 1941, respectively, is recommended.

A glass batch of the following composition has been desirable:

	Parts by weight
Sand	110
Potassium carbonate	10
Sodium carbonate	40
Calcium oxide	13
Aluminum oxide	3.5
Cuprous oxide	0.25
Stannous oxide	0.32
Sodium cyanide	1.25

In general, the presence of calcium oxide and aluminum oxide in the batch is desired in that these substances tend to improve the color of the final product. The presence of stannous oxide, although not essential, is generally desirable in that it improves the color striking property of the glass. Aluminum oxide also causes the color to strike more readily and this effect appears to increase somewhat as the portion of aluminum oxide is increased.

The particular cyanogen compound or mixture of such compounds that is best employed in a glass batch will depend upon the other batch ingredients, as well as upon the color requirements of the desired ware. The alkali metal cyanides, e.g. sodium cyanide, are generally suitable for use in any copper ruby glass batch and their use is generally preferred in that it does not involve the introduction of metallic constituents which impart color to the glass. The amount of cyanogen compound not exceeding about 1 to 2 parts per 100 parts of sand is sufficient to produce generally satisfactory results, although larger amounts, e.g. amounts equal to 5 to 10 parts by weight of the batch, may be used in specific cases.

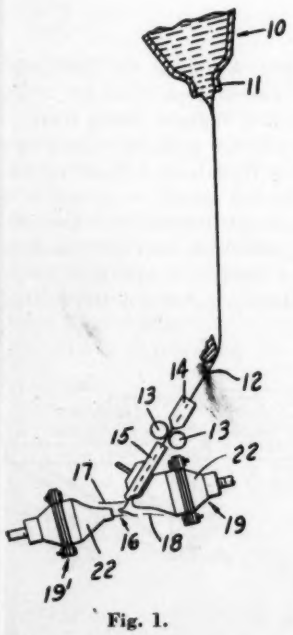


Fig. 1.

In general, excellent results may be obtained by adding such amount of bismuth or bismuth compound that the bismuth content of the finished glass corresponds to 0.01 to 0.3% of bismuth oxide (Bi_2O_3).

Annealing the glass for approximately twenty minutes at 1100 to 1150°F. has given desirable results.

The patent contains two claims and the following references were cited: 2,174,554, Dobrovolny et al., Oct. 3, 1939; 2,233,343, Dobrovolny et al., Feb. 25, 1941; 2,354,164, Weil, July 18, 1944; and *J. Soc. Glass Tech.*, vol. 29, 1945, pages 335, 386, 387.

Glass Wool and Fiber

Method of Producing Fibers. Fig. 1. Patent No. 2,643,415. Filed July 19, 1949. Issued June 30, 1953. One sheet of drawings. Assigned to Owens-Corning Fiberglas Corporation by Charles J. Stalego.

An improved method and apparatus for producing fibers from glass or materials of the type which become soft in the presence of heat, and are capable of being drawn out when softened to form fibers.

The gas forming the blast has a temperature high enough to melt the advancing end of the rod as it is projected into one side of the blast, and has a velocity sufficient to attenuate the heat softened glass or material to form fibers.

As shown in Fig. 1 molten glass is contained in a feeder 10 which possesses a plurality of orifices 11 at the bottom through which molten glass flows in the form of individual streams. The streams are attenuated to form rods or filaments 12 by a pair of rolls 13.

The filaments 12 are directed between the rolls 13 by a guide 14 having a plurality of vertically extending passages spaced laterally from each other in a row and corresponding in number to the number of the filaments 12. The guide 14 is supported above the rolls 13 in a position to respectively receive the filaments 12 and guide the same between the rolls 13. A second elongated guide 15 is suitably supported directly below the rolls 13 and is formed with a series of passages for respectively receiving the filaments 12 leaving the delivery side of the rolls 13. Thus the rolls 13 serve the further purpose of feeding the filaments 12 downwardly through the guide 15.

The filaments leaving the lower end of the guide 15 are projected into a composite blast 16 of gas having a temperature which exceeds the softening point of the glass and having a velocity sufficient to attenuate softened glass to form fibers of specified degree of fineness.

As the heat softened ends of the rods are projected into the blast 18, the glass reverses its direction of movement and is attenuated by the force of the blast 18. The fibers resulting from this attenuation are carried by the blast 18 in a general downward direction, and may be collected on a suitable conveyor not shown herein.

The patent contains 11 claims and the following references were cited: 2,489,242, Slayter et al., Nov. 22, 1949 and 2,499,218, Hess, Feb. 28, 1950.

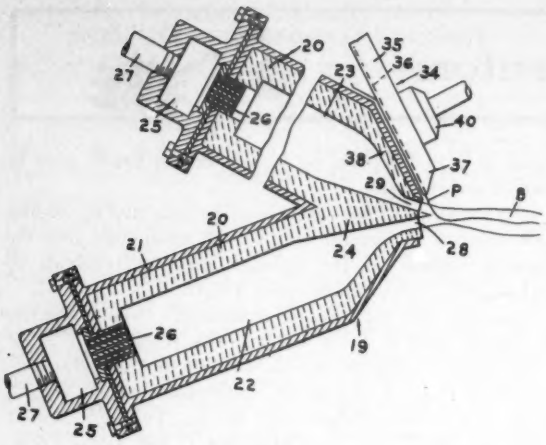


Fig. 2.

Fibers From Glass. Fig. 2. Patent No. 2,645,814. Filed November 2, 1948. Issued July 21, 1953. Three sheets of drawings. Assigned to Owens-Corning Fiberglas Corporation by Charles J. Stalego.

An improved method is shown for producing fibers from thermoplastic or heat-softenable materials. A burner assembly is shown in Fig. 2 having a restricted outlet through which the products of combustion are discharged in the form of a high velocity gas.

Owing to the fact that the depth of the blast in the attenuating zone is increased, it is possible to feed primary filaments of a given size at a greater rate into the blast, or larger primary filaments may be introduced into the blast without the danger of projecting the filaments through the opposite side of the blast before heating the filaments to the proper attenuating temperature.

The entrant or rear end of each combustion chamber communicates with an intake manifold 25 through a perforated plate 26 and a supply conduit 27 is connected to each intake manifold 25 to supply a specified gaseous fuel mixture to the respective combustion chambers. The front walls of the combustion chambers are formed with outlet openings or passages 28 and 29, respectively, located on directly opposite sides of the common wall portion 24. In operation the selected gaseous mixture admitted to the inlet manifolds 25 passes through the orifices in the plates 26 where it ignites and burns in the two chambers with a resulting high degree of expansion.

The glass or other heat softenable material selected is fed into the blast B in the form of primary filaments or solid rods P. The primary filaments are fed into the blast B along a path extending diagonally across the blast. The arrangement is such that the effective depth of the blast available for melting or softening the advancing ends of the primary filaments is increased. When considering that the depth of the blast is also substantially increased by virtue of the two individual streams issuing from the burner, it follows that ample time is available for softening or melting primary filaments of substantial diameter before the filaments are projected through the bottom side of the blast. Thus primary filaments having greater diameter and/or moving at a faster rate may be softened in the blast to the attenuating temperature, and the capacity of the burner to form secondary fibers is greatly increased.

Other refinements and advantages are evident from a study of the various drawings. The patent contains 17 claims and the references cited were: 1,008,204, Seghers, Nov. 7, 1911; 1,328,446, Odam, Jan. 20, 1920; 2,126,411, Powell, Apr. 17, 1934; 2,457,777, Holtschulte et al., Dec. 28, 1948; and 2,499,218, Hess, Feb. 28, 1950.

Apparatus for Forming Glass Fiber Mats. Fig. 3. Patent No. 2,653,416. Filed June 30, 1950. Issued September 29, 1953. Four sheets of drawings. Assigned to Owens-Corning Fiberglas Corporation by Games Slayter.

The present invention relates to the production of mats of fibrous material and more particularly to improved apparatus for producing wide, thin mats of uniform thickness from mineral fibrous material, especially glass fibers. An object of the invention is the provision of means for continuously redirecting the flow of glass fibers as they are formed to provide a mat of uniform thickness.

Figure 3 illustrates a modified form of the invention in which the vanes 50 may be in the form of angle irons welded to pivot rods 52 mounted in bearings 53 which in turn are secured to a frame structure 54. Oscillation of the vanes 50 is accomplished by means of a reciprocating rod 56 mounted on the outside of the frame 54 in bearing blocks 57. The block 67 is adapted to be adjustably secured to the crosshead 68 to produce an eccentric motion as the shaft 69 is rotated by a suitable source of power. Thus it will be noted that reciprocation of the shaft 56 imparts oscillating motion to the vanes 50.

The vanes may be oscillated at any desired rate, for instance, 100 to 240 oscillations per minute depending upon the resulting arrangement of the fibers forming the mat. The modified apparatus provides a means of eliminating non-uniformities in the mat. Otherwise the process follows conventional means of producing glass fiber mats.

The patent contains 11 claims and the references cited were: 1,864,317, Powell, June 21, 1932; 2,103,769, Drill, Dec. 28, 1937; 2,230,270, Simpson, Feb. 4, 1941; 2,287,006, Kleist et al., June 16, 1942; 2,518,744, Barnard, Aug. 15, 1950; and 2,565,951, Barnard, Aug. 28, 1951.

Sheet and Plate Glass

Laminated Sheet Glass. Fig. 4. Patent No. 2,652,660. Filed February 20, 1951. Issued September 22, 1953. Two sheets of drawings. Fredrik Wilhelm Anton Kurz.

A novel method is described for producing laminated sheets suitable for shadowing light from a lightning fixture. A preliminary sheet is first formed composed of a plurality of elongated glass strips disposed side by side. Heat is then applied until sufficiently soft for drawing, after which the preliminary sheet is drawn in a longitudinal direction until the sheet is reduced to the desired thickness.

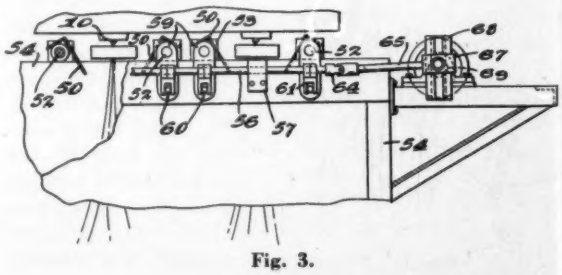


Fig. 3.

Fig. 4.

Figure 4 illustrates how the thickness of the original sheet 3 is reduced by drawing the sheet in the longitudinal direction of the strips. The arrows indicate the direction of the drawing operation. For the purpose of drawing, the sheet may be disposed horizontally, vertically or in any other position. The drawing operation is basically the same as is employed for the drawing of conventional window panes. The same steps are taken to maintain an even width and thickness of the sheet and to secure the proper cooling of the finished sheet. The finished laminated sheet is surface patterned by means of transverse grooves and further ornamented by the insertion of colored strips which are disposed at right angles to the longitudinal direction of the strips.

It is also possible to employ as starting material liquid glass, which can be extruded or drawn from nozzles in the form of strips or layers, these nozzles being disposed side by side. If strips are used, thick and clear strips of glass may be combined with strips composed of thinner and colored glass, in which case both kinds of glass should have the same expansion coefficient.

The patent contains seven claims and the references cited were: Re. 21,313, Desagnat, Jan. 2, 1940; 631,220, Manning, Aug. 15, 1899; 1,734,965, Danner, Nov. 12, 1929; 2,122,246, Clewell, June 28, 1938; 2,183,961, Fischer, Dec. 19, 1939; 2,193,207, Rosen, Mar. 12, 1940; 223,379, Germany, Oct. 27, 1908; and 384,097, France, Mar. 28, 1908.

Glass Cutting Machine. Patent No. 2,650,430. Filed February 9, 1950. Issued September 1, 1953. Eleven sheets of drawings (none reproduced). Assigned to American Window Glass Company by Norman H. Klages.

This invention relates to a glass cutting machine for automatically making an accurate transverse cut on a vertically moving sheet of glass so that the cut extends at right angles to the direction of movement of the glass sheet. The machine is of the general type in which there is a cage adapted for vertical movement alongside the rising sheet of glass. The cage carries a cutter carriage which moves transversely across the glass sheet and the cage supports a glass measuring stop which contacts the advancing edge of the sheet. The cage is raised by chains connected to it and passing over sprockets on a cage lift shaft located adjacent the top of the machine. The cage lift shaft is driven from the conveyor rolls which move the glass sheet upwardly, the cage lift shaft being driven from the conveyor rolls by means including a clutch so that the cage lift shaft can be engaged and disengaged from the conveyor rolls.

After the cage has begun to rise and when it is desired to make a cut across the sheet, the unbalanced weight of the cage is caused to be taken by the glass sheet so as to insure that the cage and the sheet rise at the same rate in order to make an accurate cut across the sheet. During the first part of the rise of the cage, the cage is driven from the glass sheet conveyor rolls so that the extra lift required to rapidly accelerate the speed of the cage is not taken by the glass sheet, but thereafter when the sheet is about to be cut the weight of the cage is taken by the sheet so as to insure an accurate cut.

The patent is well illustrated with drawings and a thorough study of these illustrations is advisable to comprehend the advantages. The patent contains ten claims and the references cited were as follows: 1,988,580, Tasher, Jan. 22, 1935; 2,111,393, Gaskell, Mar. 15, 1938; 2,260,103, Hinkle, Oct. 21, 1941; and 2,323,686, Sommerfeld, July 6, 1943.

Glass Cutter. Fig. 5. Patent No. 2,652,659. Filed October 27, 1950. Issued September 22, 1953. One sheet of drawings. Assigned to Fletcher-Terry Company by Arthur T. Fletcher.

Improved construction is shown in Fig. 5. In order to retain the axle 18 in position within the opening 17, the annular edges of the opposite ends of the opening are projected inwardly, as shown at 17. The edges are projected by a spinning or swaging operation, or in any other suitable manner, and it will be noted that they are spaced from the ends of the axle 18 and thereby permit longitudinal movement of the axle so that the wear by the rotation of the wheel will be distributed over a greater portion of its length instead of being concentrated at one point.

The improved construction of the cutting wheel holder is of particular advantage since, by constricting the ends of the opening 17 to retain the axle 18, it eliminates the necessity of heading the opposite ends of the axle or otherwise shaping it to retain it in the hub of the holder, permitting the use of a hardened axle.

The patent contains two claims and the references cited were: 742,179, Fletcher, Oct. 27, 1903; 1,221,076, Monce, Apr. 3, 1917; 1,634,323, Fletcher, July 5, 1927; 1,870,585, Parks et al., Aug. 9, 1932; 1,884,635, Fancher, Oct. 25, 1932; 2,096,284, Lee, Oct. 19, 1937; 2,254,162, Wyman, Aug. 26, 1941; 2,341,030, Fletcher, Feb. 8, 1944; and 2,566,544, Wyman, Sept. 4, 1951.

Tube and Cane Machines

Apparatus for Drawing Vitreous Tubes and Rods. Fig. 6. Patent No. 2,653,418. Filed October 13, 1949. Issued

Fig. 5.

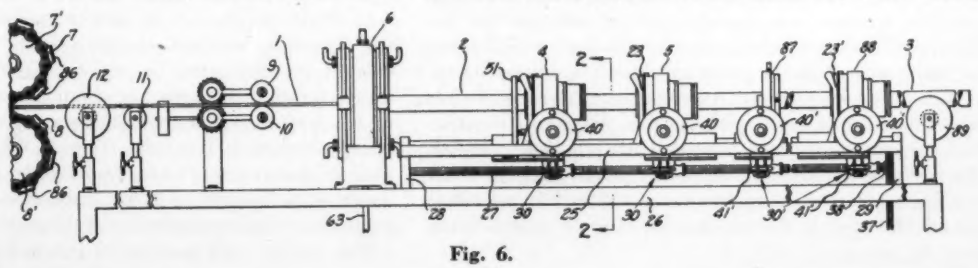


Fig. 6.

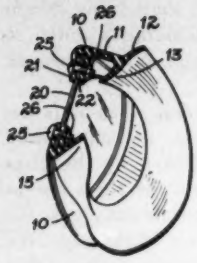


Fig. 7.

September 29, 1953. Three sheets of drawings. Assigned to General Electric Company by Bernard Shaw.

Apparatus for drawing tube or rod of vitreous material, particularly quartz or a glass of a high silica content, is shown in Fig. 6. This is accomplished by introducing a very large quantity of heat uniformly into a definite restricted area of a slug of glass after which drawing off in the form of a tube or rod is accomplished.

Automatically established movements in the chucks 4 and 5 advance the slug 2 along the drawing axis and into the cone of flame emitted by the burner assembly 6 where the end is heated to drawing temperature. The smaller tube 1 is drawn from the heated end of the slug 2 by pulling means of the usual design which is represented only by the portion of the endless belts 7 and 8. The size of the drawn tube 1 is dependent upon automatic functions of the apparatus affecting both the slug 2 and the tube 1, in particular, the rate of advance of the slug 2, which is associated with the feeding of heated quartz, and the rate of movement of the pulling means, which draws off the finished tube 1. The pulling means represented by the endless belts 7 and 8 is disclosed in Danner Patent 1,220,201, dated March 27, 1917.

Continuous operation is provided by the introduction of slug 3 to the free end of slug 2. This is accomplished and controlled by the operator and fusion of slugs 2 and 3 is effected by special burners 87 and chuck 88. The design of burners 87 and 6 are highly important and complicated.

The satisfactory coordination of the heating, drawing and feeding operations in a manner suitable for low cost commercial production of quartz and related materials is afforded by the invention.

The patent contains eight claims and 10 references.

Miscellaneous Processes

Goggles. Fig. 7. Patent No. 2,648,843. Filed January 10, 1951. Issued August 18, 1953. One sheet of drawings. Jack B. Hirschmann.

As shown in Fig. 7, the outer flange 12 is formed to fit smoothly around the goggle against the forehead, temples and cheeks of the wearer, but is relieved at the nose receiving portion of the goggle. The flange portion 13 extends generally inwardly from the frame portion 11 for similarly seating against the face of the wearer and includes a central web portion 15 adapted to seat on the bridge of the nose of the wearer to complete the sealing action in the junction between the goggle frame and the wearer's face.

The rim 10 of the goggle is formed to define a single viewing aperture comprising a pair of enlarged eye portions and a connecting portion of reduced vertical extent at the center of the goggle and above the wearer's nose.

When this goggle is assembeld with the flexible lens and attaching bolts in place and is fitted on a wearer, the eye chamber of the goggle is entirely sealed against the possible passage of corrosive fluids capable of injuring the wearer's eyes, the flanges 12 and 13 providing an effective seal at the junction between the goggle frame and the face.

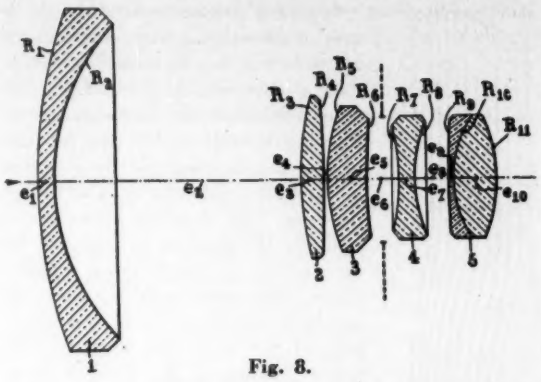


Fig. 8.

The patent contains two claims and the references cited were as follows: 2,435,653, Maurre, Feb. 10, 1948; 2,526,181, Wilen, Oct. 17, 1950; 2,552,409, Wilen, May 8, 1951; and 617,617, Germany, Aug. 22, 1935.

Wide-Angle Photographic Objective Lens Assembly. Fig. 8. Patent No. 2,649,022. Filed July 29, 1950. Issued August 18, 1953. One sheet of drawings. Pierre Angenieux.

It is known that in some photographic or cinematographic cameras, notably of the Reflex type, it is not possible to use conventional wide-angle objectives, since these could not be placed sufficiently near to the sensitive surface for obtaining a suitable focusing of the camera. The space occupied by the mirror in Reflex cameras or by the shutter in cinematographic cameras is too large for permitting the use of objectives wherein the distance between the last lens and the focal plane is short.

One solution to the problem is shown in Fig. 8 and Table 1 in which an objective having a 1:2.5 aperture and an effective field angle of 65°.

Table 1 for F = 100

Radiuses	Thicknesses and Distances	Glass Quality n_D	Glass Quality v
$R_1 = +180.48$	$e_1 = 6.33$	1.6145	59.8
$R_2 = +84.06$	$e_2 = 93.18$	air	
$R_3 = +114.40$	$e_3 = 9.12$	1.6243	46.8
$R_4 = -415.25$	$e_4 = 0.51$	air	
$R_5 = +69.18$	$e_5 = 17.22$	1.6226	53
$R_6 = +237.45$	$e_6 = 9.12$	air	
$R_7 = -93.48$	$e_7 = 4.30$	1.6141	37
$R_8 = +50.54$	$e_8 = 10.13$	air	
$R_9 = +404.42$	$e_9 = 2.28$	1.6287	35.3
$R_{10} = +38.74$	$e_{10} = 16.20$	1.6391	55.8
$R_{11} = -55.20$			

Back focal length = 105

In this table, $R_1 \ldots R_{11}$ are the values of the radii of the refracting surfaces counting from the front to the rear of the objectives (e_2, e_4, e_6, e_8) are the axial distances between the lenses or components, and (e_1, e_3, e_5, e_7, e_9, $_{10}$, e_{11}) are the axial thicknesses of the lens or components counting from the front to the rear of the objectives and (n_D), (v) are, respectively, the values of the index of refraction and the dispersion ratios or Abbe numbers of the lens materials of the several lens elements.

The patent contains eight claims and 11 references.

Research Digest

Mechanism of Polishing Glass

The question of whether polishing is a removal operation which takes away glass from the high regions or a flow operation which fills in the low regions at the expense of the high regions has been debated since the time of Herschel.

Herschel believed it was merely fine grinding. In 1901 Lord Rayleigh presented evidence that a thickness of glass approximately 1/10,000 of an inch was removed during polishing. In 1907 Beilby published data upon which he based his flow theory. French published in 1917 more evidence to support the flow theory and introduced the term, "β layer". In 1922 Thompson published a paper contending that the polishing particles became automatically imbedded in the pitch lap to the same depth and cut as planing tools. He based his belief upon the observed smooth-bottomed grooves cut by large rouge particles. The observations of all these researchers were obtained with the aid of a lens system. In 1947 Tolansky and Wilcox discussed the fine structure on their multiple-beam fringes due to polish marks on their reference flats and reported local areas of the order of a square millimeter which were true to better than $\lambda/250$. In 1948 Tolansky stated, "It appears that glass flows during polishing, leaving a surface smooth locally to within molecular dimensions apart from characteristic polish scratches." He did not point out specific observations which indicated flow of glass during polish. In 1949 Ehrenberg reported surface irregularities of $\pm$ 10A on glass optical flats. He obtained this information from the study of the effect of imperfections of optical flats on the reflection of X-rays. In 1949 Ray reported his observations of a polished glass surface obtained with the aid of an electron microscope. He believed that his observations supported the flow theory. In 1951 Heavens studied the irregularities on optical flats with Fizeau fringes. He reported irregularities in the range 10A—40A.

In the September 1953 issue of the *Journal of the Optical Society of America*, W. F. Koehler reports on the mechanism of polishing glass as determined by the use of multi-beam fringes of equal chromatic order. The observed shape and size of the irregularities on a polished glass surface combined with the shape and magnitude of the measured cutting rate curve is considered support for Thompson's planing theory.

Fringe shifts represent changes in thickness of the interference film. According to the equation $n\lambda = Zt$, a shift toward longer wavelength represents an increase in t or a valley on one or both surfaces whereas a shift toward shorter wavelength represents a hill on one or both surfaces.

The observed abrupt fringe shifts toward longer wavelengths are believed to be contour lines of wide grinding cracks. This interpretation is based upon the observation that they disappear with additional polishing.

The gradual fringe shifts toward longer wavelengths are contour lines across a grinding pit. It is possible to measure the size and shape of a grinding pit. These features also disappear with additional polishing.

The fine cycloid-like structures on the fringes with cusp points in the direction of shorter wavelengths are believed to be contours of surface irregularities resulting from polishing. They always appear on fringes of low order of interference associated with a polished glass surface. The cusps are believed to be contour lines of cones with conchoidal sides and not contour lines of ridges. This interpretation is based upon the observation of the fringes associated with two adjacent regions separated by a distance less than the average distance between cusp points. In general, the cusp points for the two regions do not coincide. Furthermore, if one scans an irregularity by using the fine micrometer screw of the microscope stage he can observe the cusp on the fringe which is the contour of the irregularity, increase to a maximum and then decrease within a distance less than the average distance between the cusp points. This observation indicates that the irregularity is not a ridge and has circular symmetry. Still further, this interpretation is compatible with the motion of the glass surface relative to the pitch lap during polishing.

The round smooth-bottomed regions between the cusp points indicate a planing mechanism. That is, each imbedded barnesite particle cuts in a manner similar to a wood plane. The near tangency of these smooth-bottomed regions to a smooth line is evidence that the barnesite particles are imbedded in the pitch lap so that they protrude nearly the same distance.

The cusps on the fringes reveal the shapes of the fundamental irregularities remaining on a surface after polishing. If flow of glass took place during polishing, one would not expect to find sharp cusp points on the fringes because the high spots on the glass surface would be rounded off. This aspect of flow can be observed on the fringes associated with a polished metal surface.

The size and shape of the irregularities on a polished surface, their variation with time of bowl-feed polish, the measured cutting rate curve and the shape of the cutting rate curve may be considered support for the Thompson planing theory of polishing.

The maximum average rate of removal of glass of 11.5A per stroke is compatible with Lord Rayleigh's belief that glass particles are removed during polishing which are of molecular dimensions. The material removed does not come off as a ribbon-like shaving, but probably pulverizes as cast iron does when machined on an ordinary lathe. Thus, there must be a constant flow of pulverized glass from the pitch-glass interface. Also, if the cutting particles are continuously breaking up, then there must be a constant flow of new barnesite particles to the pitch-glass interface. It is hoped that a similar study varying the nature of the particle, particle size, concentration of particles and the liquid in which the particles are suspended will yield an understanding of this two-way flow of particles because it is believed to be

(*Continued on page* 690)

Earl R. Flatter, Vice President of Overmyer Mould Company, Inc., addresses audience at Service Award Banquet.

OVERMYER SERVICE AWARDS DINNER

For the seventh consecutive year, Overmyer Mould Company, Inc. held its service awards dinner, bringing membership in the OMCO Twenty-Five Year Club to a total of 46. More than 200 persons participated in the affair, three new members were inducted into the Club, and due honors were paid to five with 30 years or more of service and to past quarter-century Club members.

Honor was also paid to six men who in 1953 completed their apprenticeships, and members with service records of 20, 15 and 10 years were, for the first time, presented with service award pins. Of special note is the fact that for the first time in the company's history a woman has been with the firm for 15 years.

During 1947 the Overmyer company celebrated its 25th year of business and it was at this time that special recognition was made to honor those employees who began with the company, establishing service awards.

PLAQUE COMMEMORATES BAUSCH & LOMB FOUNDING

A plaque commemorating the 100th anniversary of the founding of Bausch & Lomb Optical Company was unveiled in the Reynolds Arcade Building at Rochester, New York, site of the first location of the firm.

The plaque, presented by the company's Early Settlers Club, an organization of employees who have been with the firm for 25 years or more, reads: "Here in the old Reynolds Arcade, John J. Bausch, founder of Bausch & Lomb Optical Company, opened his first shop November 3, 1853. This commemorative plaque presented by the Bausch & Lomb Early Settler's Club on the occasion of the company's one hundredth anniversary."

From its beginning in a small shop in downtown Rochester, Bausch & Lomb has grown to facilities there that now cover 1,500,000 feet of floor space and additional factories in the United States, Canada and Brazil. A total of 8,000 people are now employed by the firm.

NATIONAL BUREAU OF STANDARDS NAMES CHIEF OF NEW SECTION

Dr. James L. Thomas, former Chief of the Resistance Measurement Section of the National Bureau of Standards, has been appointed Chief of the newly-organized Resistance and Reactance Section of the Bureau's Electricity Division.

The Section, under Dr. Thomas, is concerned with precision electrical resistance, capacitance and inductance measurements. Dr. Thomas has been with the National Bureau of Standards since 1927 and has made many contributions to the field of electrical measurements.

FISCHER & PORTER FORMS NEW DIVISION

Creation of the Special Products Division for development of special instruments and instrument components to contract specifications has been announced by Fischer & Porter Company as the latest step in its planned program for expanding its service to industry. Edward H. Muhleisen, who has served both as field engineer and applications engineer for the firm, has been appointed Manager of the new division.

Special projects will be handled to develop instrumentation for difficult applications relating to point-of-measurement or remote indication, recording, and/or control of such variables as flow, pressure, temperature, level, specific gravity, viscosity, consistency and others.

CONSOLIDATED FELDSPAR EXPANSION

International Minerals & Chemical Corporation is making substantial progress in the expansion program of its Consolidated Feldspar Department in the Industrial Minerals Division, Norman J. Dunbeck, Vice President in charge of the Division, has announced.

In addition to planning three new plants, existing equipment is being enlarged and brought up to date. Power equipment is being replaced with new and larger units. Dust collecting and water clarification systems are being installed. Flotation capacity of Spruce Pine, North Carolina, has been increased by 50 per cent, and new fine-grind facilities installed in Erwin, Tennessee. The main quality control laboratory at Kona, North Carolina, has been revised and enlarged.

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during September 1953 was as follows: *Flat Glass:* A preliminary figure of 32,000 persons were employed during September, indicating a rise of 1.5 per cent over the 31,600 reported for August. *Glass and Glassware, Pressed and Blown:* An increase of 1.4 per cent is shown for September with employment at a preliminary 91,100 persons. August employment was 89,800. *Glass Products Made of Purchased Glass:* September employment was a preliminary 14,000, which is 1.4 per cent below the adjusted figure of 14,200 reported for August.

Payrolls in the glass industry during September were as follows: *Flat Glass:* A preliminary payroll figure of $12,751,787 was reported, indicating a drop of 1.5 per cent from the adjusted $12,949,755 reported for August. *Glass and Glassware, Pressed and Blown:* Payrolls were a preliminary $27,582,347 during September. This is an increase of 3.2 per cent when compared with the adjusted $26,706,221 reported for August. *Glass Products Made of Purchased Glass:* Payrolls during September were a preliminary $3,567,200, or 1.9 per cent below the adjusted $3,638,466 for August.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

	October, 1953
Narrow Neck Containers	
Foods	1,031,990
Medicinal & Health Supplies	1,092,290
Chemicals, Household & Industrial	741,408
Beverages, Returnable	418,766
Beverages, Non-returnable	92,585
Beer, Returnable	143,944
Beer, Non-returnable	763,954
Liquors	1,076,169
Wines	359,767
Toiletries & Cosmetics	571,259
Sub-total (Narrow)	6,292,132
Wide Mouth Containers	
Foods	*2,849,729
Dairy Products	301,478
Medicinal & Health Supplies	338,540
Chemicals, Household & Industrial	156,101
Toiletries & Cosmetics	130,813
Packers' Tumblers	160,350
Sub-total (Wide)	3,937,011
Total Domestic	10,229,143
Export Shipments	284,627
TOTAL SHIPMENTS	10,513,770

*This figure includes Home Canning.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All Figures in Gross)

		Production October 1953	Stocks October 1953
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	3,666,117	3,764,480
	Wide Mouth	*3,612,846	*3,598,269
Dairy Products		354,245	325,223
Beverages, Returnable		623,409	1,076,915
Beverages, Non-returnable		103,274	129,312
Beer, Returnable		190,421	188,019
Beer, Non-returnable		777,140	506,802
Liquors		1,190,061	884,236
Wines		393,667	333,116
Packers' Tumblers		177,046	189,212
TOTAL		11,088,226	10,995,584

*This figure includes Home Canning.

Glass container production, based on figures released by the Bureau of Census, continued on the upswing during October and was 11,088,226 gross. This is 8.5 per cent higher than the 10,214,158 gross produced during September. During October 1952, production of glass containers was 10,704,172 gross, which is 3.5 per cent less than for October this year. Thus far in 1953, manufacturers have produced a total of 104,509,998 gross of glass containers. Compared with the 98,492,925 gross produced during the same period in 1952, production for 1953 is 6.1 per cent higher than for last year.

Shipments of glass containers during October 1953 were 10,513,770 gross. Compared with the previous month's shipments of 10,803,202 gross, October shipments were 2.6 per cent off. Shipments during October 1952 were 10,375,390 gross, or 1.3 per cent less than for October this year. At the end of the January-October 1953 period, glass container manufacturers have shipped a total of 102,685,072 gross, which is 5.3 per cent higher than the 97,482,969 gross shipped during the same period in 1952.

Stocks on hand at the close of October 1953 were 10,995,584 gross. This is 4.4 per cent higher than the 10,526,960 gross on hand at the end of September and 11.5 per cent higher than the 9,853,623 gross on hand at the end of October 1952.

Automatic tumbler production during September 1953 was 4,810,498 dozens. This is 5.2 per cent less than the 5,704,610 dozens produced during August. During September 1952, production was 3,816,452 dozens. Shipments of automatic tumblers during September 1953 were 4,785,245 dozens. Compared with the 5,388,554 dozens shipped during August, a drop of 11 per cent is indicated. Shipments during September 1952 were 4,050,124 dozens. Stocks on hand at the end of September 1953 were 10,075,102 dozens. This is .3 per cent less than the 10,107,240 dozens on hand at the end of August. Stocks at the end of September 1952 were 8,389,443 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware during September 1953 rose 16.6 per cent to reach 3,792,654 dozens. During August, 3,252,413 dozens were sold. Sales during September 1952 were 3,308,373 dozens. At the close of the 12-month period ending September 1953, manufacturers had sold a total of 41,917,121 dozens. This is 6.8 per cent higher than the 39,217,729 dozens sold during the corresponding period in 1952.

Left to right: F. B. Pollock and F. K. Rodewald.

THATCHER GLASS ELEVATES TOP EXECUTIVES

The Board of Directors of Thatcher Glass Manufacturing Company, Inc. named Franklin B. Pollock, currently President of that organization, to the post of Chairman of the Board and Chief Executive Officer. F. K. Rodewald, Executive Vice President under Mr. Pollock, will assume the presidency. The changes will become effective on January 1, 1954. Both men have served in their present positions for the past ten years.

In an announcement following their meeting, a spokesman for the Board stressed the fact that Mr. Pollock will continue to take an active part in Thatcher management. The election to Chairman of the Board was to free him of the day-to-day requisites of the presidency, allowing him time to devote to pressing policy matters.

In accepting the new position, Mr. Pollock thanked the Board of Directors for its splendid cooperation in the past, and stated that he was counting "on your continued support in the future to fully develop the pattern for progress which has been set in the last ten years."

A. P. GREEN APPOINTMENTS

Announcement has been made by A. P. Green Fire Brick Company of the appointment of L. L. Edwards as General Manager of its new direct representative and distributor organization, A. P. Green Fire Brick Company of Texas.

Mr. Edwards has been associated with A. P. Green company for over 25 years. During that time he has been connected with various phases of its operation, including factory, office, sales territory and as an executive in distributor organizations.

Also announced is the appointment of Ed C. Miller as District Sales Manager of the Indianapolis office. Mr. Miller has been connected with the company for many years. During that time he has served in various phases of its operation, primarily sales. Prior to his present appointment he was a Sales Supervisor at the Mexico home office. He is a graduate of the University of Missouri.

• Dr. Alexander Silverman, consultant on the production, research and development of glass, visited the New York State College of Ceramics at Alfred University to discuss cataloging and displaying the collection of glassware which he has presented to the University. The collection is considered the most representative of modern glass produced within the past 100 years.

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Morgantown Glassware Guild switches to Complete Round of Laclede-Christy Cast Pots

for BETTER GLASS
LONGER POT LIFE
LOWER FURNACE TEMPERATURES AND LESS FUEL

The Morgantown Glassware Guild, Inc., of Morgantown, West Virginia, melting lead glass, has written us as follows:

"We wish to report that on the first two cast pots No. 13 and 14, which were used experimentally in our factory, that we were able to get 56 melts out of No. 13 and 80 melts out of No. 14.

"We also are pleased to report that by September 9th, we will have a complete round of L-C 100% Cast Pots in our furnace. We can report that we are most pleased with the results we have received from this new type of unit and that we not only anticipate drawing better glass from this unit but expect to get longer service from each individual pot as well as being able to operate our furnace at from 40 to 70 degrees cooler than when we were melting glass in hand-made pots."

This modern trend to 100% Cast Pots is now being adopted successfully by many glass manufacturers throughout the country and with very encouraging results.

Up to the present time (over 16 months since the first L-C 100% Cast Pot was shipped) not one L-C Cast Pot has been lost in shipping, arching, or setting.

Quality First

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ARCADE BUILDING • ST. LOUIS 1, MO.

Glass Refractory Division
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Cast Fluxlite • Super Refractory Mix 89 • Fortified Super Refractory Mix 257 • Firebrick and Cements • Silica Brick and Silica Mortar #152

New Equipment and Supplies

NEOPHAN ABSORPTIVE LENSES

Fish-Schurman Corporation, 70 Portman Road, New Rochelle, New York, has announced development of its Neophan absorptive lenses, particularly suitable for glass blowers, and those subjected to an intense yellow flame.

Neophan is a special absorptive glass with rare earth ingredients and is protected by patents. The special glass effectively removes the yellow sodium light rays present when heating glass with the conventional glass torches. The intense, annoying yellow glare is completely removed, and the ultraviolet region, which produces a burning effect on the eyes, is cut out. In such cases where the intense flame also gives off long wave infrared radiation, the Neophan lenses should be supplemented by the wearing of a light shade of welding glass, which will absorb the harmful infrared region.

Neophan lenses have a light blue-gray neutral tint and, in a 2mm. thickness, will completely eliminate the strong yellow sodium light.

NEW ITALIAN GRINDING MACHINE FOR MIRRORS

The Pasquinucci Glassworks, Pontedera, Italy, has recently produced a dry grinding machine with endless belt for use in mirror manufacturing. It has high output and is particularly fit for preparing shaped glass sheets.

The machine features powder suction applied in its lower and upper parts in order to protect the operator from silicosis, an adjustable stretcher which puts the belt in the desired position and facilitates the handling of glass sheets. By employing belts of very fine grain, it is possible to avoid the use of sandstone and wood or cork wheels. Principal characteristics: belt, 2700 x 100; motor, 1,25 HP; height, 205 meters.

DIAMOND DRESSING TOOL

United States Diamond Wheel Company, Aurora, Illinois, has announced a new diamond dressing tool that cuts the cost of diamond wheel operation and assures longer carbide tool life between grinds, according to the manufacturer.

The device is a hand hone tipped with diamond concentrate and with a new patented feature that insures more accurate operation — finger-tip control by means of a hollowed-out finger rest near the end of the hone. It is available in single or double end styles and in all required diamond grit sizes.

The finger-tip control permits the hone to fit firmly in the hand for accurately controlled tool dressing without removing the tool from the machine.

PROTECTIVE COATING

Babbitt Steam Specialty Company, Babbitt Square, New Bedford, Mass., has recently introduced its "Formula 67" protective coating recommended for glass, metal, brick, unglazed tile, etc. The Babbitt multi-purpose coating is acid proof, rust resistant, waterproof, alkali proof and grease proof.

"Formula 67" is applied with brush or spray, needs no primer or base coat on properly cleaned surfaces and needs no after coat. It is said to dry in 20 minutes without dryers, and with no tackiness. Its colors, in a wide range of those most generally demanded, are permanent and will not chalk or fade from the effects of the weather.

CATALOGS RECEIVED

Wheelco Instruments Division, Barber-Colman Company, Rockford, Illinois, has announced publication of an Education Bulletin F 6149 on "Temperature Control Systems". An informative section will help in the selection of sensing elements and their correct use for the most satisfactory results. Instrument industry control terminology is given in the booklet, as well as rules to follow in selection of the proper method of temperature control for process characteristics or reaction.

A complete explanation is contained of the various types of control systems, ranging from two-position "on-off" to proportional position with automatic reset. Where to use each system and what instruments are required for the best control results are clearly answered in this bulletin.

Weighing Components, Inc., 64 Fulmor Road, Hatboro, Pa., has issued literature describing its new platform weighing scale adaptable for batch or continuous process control.

The W/C Weighing Scale Catalog 10 illustrates the scale and describes the various features.

Minneapolis-Honeywell Regulator Company, Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa., has issued Instrumentation Data Sheet No. 10.10-4 describing the new Gardner automatic photometric unit in which Honeywell amplifier and balancing motor are incorporated.

Used with the proper exposure head, it can measure such variables as reflectance, opacity, hiding power, detergency, tristimulus colorimetry, gloss, luminous transmittance, haze and other optical quantities. Readings are made automatically, with speed and high accuracy.

The company has also issued Bulletin P-811 covering the Honeywell new 077 electronic temperature controller, with range now extended to cover —100 to +600°F. The bulletin also contains complete specifications, prices and application information on the controller in both the single-point and the new cascade model, as well as data on resistance thermometer elements and wells, and Modultrol motors and industrial control motors suitable for use with the new 077.

Corning Glass Works, Plant Equipment Sales Department, Corning, New York, has announced a new, revised catalog, "Pyrex Brand 'Double-Tough' Glass Pipe and Fittings".

In addition to introducing a new line of sink traps and some new fittings, the catalog also lists the standard items of stock lengths that are available. The physical properties of glass pipe that make it especially suitable for the processing industries are discussed, as are ease of cleaning and installation and economy of operation and maintenance.

Simplex Valve & Meter Company, Philadelphia 42, Pa., has prepared a new 5-page brochure describing the Type VE venturi tube. This unit is a primary device used to produce pressure differentials from flowing liquids for the purpose of actuating rate of flow meters.

Data is given as to how any low-velocity, low-pressure flow of liquids, containing solids, can be measured in connection with a venturi meter. The tube is available for pipe lines measuring 12 to 84 inches in diameter with larger sizes to specification.

Owens-Corning Fiberglas Corporation, Toledo 1, Ohio, has made available a new 20-page publication describing and illustrating "Fiberglas Insulations for Low Temperature Structures and Equipment".

The publication describes design considerations, sets standards for vapor barriers, outlines application methods, covers dry wall and hot dip constructions and self-supporting partitions. Fiberglas products for low temperature insulations described are: preformed insulation, asphalt-enclosed board, asphalt-enclosed floor board, roof insulation and dual temperature pipe insulation. Twenty-one photographs, six charts, 19 sketches and three graphs are included in the booklet.

The Bristol Company, Waterbury, Conn., has just published a new, greatly expanded catalog of complete control systems for furnaces, oven, dryers and kilns. It has also announced the issuance of a new edition of "Pyrometer Thermocouple Calibration Data".

The new book contains all the detailed engineering specifications and prices necessary to choose and order the proper control "package" for a particular installation.

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IF alumina dust hampers your production and adds to your costs through excessive waste—*switch to Kaiser Alumina!*

Dust is minimized with Kaiser Alumina because the grains are *accurately sized* to meet specific applications. It's available in several sizes—from fine grades to coarse grades prepared for large bulk users. This careful sizing also insures *free flow* to help speed your operations.

This "tailoring" of alumina to customers' requirements was pioneered by Kaiser Chemicals. Such aggressive research on customer problems is another reason why Kaiser Chemicals has become a major supplier of calcined and hydrated aluminas, serving more than 80% of the nation's users.

Whether you manufacture abrasives, glass, ceramics, refractories, catalysts, or chemicals for water treatment, Kaiser Chemicals will give your order *immediate, individual attention*. Contact principal sales offices: Chemical Division, Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California; First National Tower, Akron 8, Ohio.

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calcined and hydrated aluminas

Alumina • Basic Refractory Bricks and Ramming Materials • Dolomite • Magnesia • Magnesite • Periclase

PLANT LAYOUT AND DESIGN . . .

(*Continued from page* 673)

Natural gas requirement (Fig. 2): (1) Spec. Grav. S = 0.60; (2) Rate of Flow = 40,000 C. F. H.; (3) Line pressure = 20 P.S.I.G. (34.7 P.S.I.A.); (4) Indicated line size = 4″; (5) Corresponding $\Delta p = 0.218$ #/sq.in./100 ft. from dotted line; (6) It is desired to employ a 6″ line, the next larger, in which case Δp will actually be much lower @ 34.7 P.S.I.A. and 40,000 C.F.H. since the 6″ will now handle 117,000 C.F.H. @$\Delta p = 0.218$; (7) Δp is proportioned to the 1.84 power rate of flow, Q_o, so that the actual frictional pressure drop for 40,000 C.F.H. in the 6″ line will be:

$$\Delta p \text{ corrected} = (0.218)\frac{(40)}{(117)}^{1.84} = 0.0303 \text{ \# sq. in. 100 ft.}$$

Other gases, compressed air and steam, can be handled in the same manner except in those cases where the true Δp corresponding to the construction of the chart must be found for 6″ size and over. Refer to Fig. 12 for uncorrected Δp, and Fig. 1 for correction factor Fq.

It must be remembered that for very long lines, several hundred feet in length, total Δp by its magnitude will begin to affect $P_{Avg.}$, the average line pressure, a noticeable amount. In this case, a new $P_{Avg.}$ (Arithmetic mean) can be quickly calculated and a new chart reading obtained. By repeated trial and error, an exact solution can be determined. In most cases of practical significance, the first reading is sufficient. The accuracy of any friction factor data in flow calculations is probably no better than plus or minus 10%. In this paper the friction factor is aimed at the high side.

In the case of liquids, oil, water and fan air, the maximum allowable Δp is a fixed value, corrected for large flow rates by Fig. 1. The charts are accordingly simpler, the actual Δp is indicated on the diagonal lines and the value of Δp off the position of any indicated maximum pipe size is obtained by interpolation between adjacent diagonal lines.

Fan air is treated as a liquid having a $P_{Avg.}$ value halfway between 4″ W. G. and 20″ W. G. line pressure. The error in this assumption is 1% or less.

The charts prove to be very effective in saving valuable man hours of work. A certain amount of discretion is required in their use in a particular case in which one may have only a limited amount of static pressure available at the source of the line. In this case he will want to waive economy and good practice and use much lower frictional resistance than ordinarily. The charts are still usable, however, in either case, or reference may be made to the formulae.

It is best to express frictional resistance through valves and fittings in terms of an equivalent number of feet of straight pipe added to the actual sum total straight pipe. This data is generally available in all handbooks, but it is generally not recognized that the reistance of fittings is a function of Reynold's Number R_e. One of the best treatments of this is to be found in Crocker's "Piping Handbook."

However, a simplified table for the above is as follows:

$$n = \frac{k}{4f}$$

Where n = number of pipe diameters in length is equivalent to the fitting in question.

k = Coefficient of resistance

f = Friction factor

Screwed Fittings:*	k	n Evaluated @ f = 0.0075
45° Ell	0.42	14
90° "	0.90	30
180° Close return bends	2.00	67
Tee	1.80	60

* For flanged fittings multiply by ¾

90° Welding Elbows and Smooth Bends	k	n Evaluated @ f = 0.0075
R/d = 1	0.48	16
R/d = 1½	0.36	12
R/d = 2	0.27	9
R/d = 4	0.21	7
R/d = 6	0.27	9
R/d = 8	0.36	12
Miter Elbows (No. of Miters)		
1 - 45°	0.45	15
1 - 60°	0.90	30
1 - 90°	1.80	60
2 - 90°	0.60	20
3 - 90°	0.45	15
Welding Tees		
Forged	1.35	45
Miter	1.80	60
Valves (Screwed, Flanged or Welded)		
Gate	0.21	7
Globe	10	333
Angle	5.0	167
Swing check	2.5	83

KIMBLE ELECTION

Fred D. Pinotti has been elected a Vice President and member of the Board of Directors of Kimble Glass Company, subsidiary of Owens-Illinois Glass Company.

A veteran of nearly 20 years of service with Kimble, Mr. Pinotti was recently appointed assistant to the General Factories Manager with direct responsibility for all technical and engineering phases of the company's operations.

Mr. Pinotti joined Kimble Glass Company in 1934 as a chemical engineer. Later he was named assistant to the Director of Research, then assistant Chief Engineer and in 1951 Chief Engineer, a title he retains along with that of assistant to the General Factories Manager. He was graduated from Bucknell University in 1934.

• A. C. Richardson, who has had supervisory charge of research in mineral processing at Battelle Institute for the past 20 years, has been named Technical Director. He, with the Institute's other technical directors, will be responsible for the technical guidance of Battelle's $13,000,000 per year research program for industry and the government.

HELP FOR YOU TODAY AND TOMORROW

Drakenfeld research men have a dual responsibility to our customers. First is the job of solving urgent color problems. Second, the task of anticipating the future needs of these glass and ceramic manufacturers. To keep informed of all that's new in processes and products, they spend a lot of time in the field. Consequently, many a question is answered before it can develop into a costly production problem.

No other customer service is more important to us than color research. We use more than 13,000 square feet of space for laboratories alone. Our research engineers have a complete technical library, thousands of case histories and the most modern equipment to aid them in formulating, testing and checking every color we manufacture. No color is ever shipped from our plant until specific standards have been met in every respect.

Whatever your color problem, consider Drakenfeld research laboratories as an extension of your own facilities. We believe our varied experience, scientific skill and friendly cooperation can help you save time and trouble. Your inquiry is cordially invited.

DEPENDABLE SERVICE ON:
Acid, Alkali and Sulphide Resistant Glass Colors and Enamels . . . Silver Paste . . . Crystal Ices . . .Squeegee and Printing Oils . . . Spraying and Banding Mediums . . . Glassmakers' Chemicals . . . Glass Decolorizers . . . Glass Frosting Compounds . . . Decorating Supplies.

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For the second consecutive year, the annual report of Owens-Corning Fiberglas Corporation was judged best in the glass industry. Carl G. Staelin, left, Secretary, accepts a bronze "Oscar of Industry" from Weston Smith, Executive Secretary of *Financial World*, sponsor of the competition. The survey included 5,000 annual reports.

FOXBORO OPENS TEXAS BRANCH OFFICE

The opening of a branch office in Amarillo, Texas, has been announced by The Foxboro Company. Located at 1117 La Paloma Street, the new branch was made necessary by expanded industrial activity in the region.

Assigned to the office as Industrial Engineer is D. T. McElligott, a graduate of Texas Technological College with a degree in Electrical Engineering.

ACHESON RE-ELECTED PRESIDENT

Howard A. Acheson was recently re-elected President and Chairman of the Board of Acheson Industries, Inc. at its annual stockholders' meeting in New York City.

Also at the New York meeting, the following appointments were announced: Raymond Szymanowitz, Vice President; P. C. Buck, Vice President; M. W. Reynolds, Vice President; and John C. Sprague, Secretary-Treasurer. Mrs. Leatha Tuer and Lester H. Miller were elected Assistant Secretary and Assistant Treasurer, respectively. Directors for the coming year are John P. Deringer, Raymond Szymanowitz, Pierre V. Heftler and John C. Sprague.

COLORADO FUEL AND IRON INAUGURATES NEW DEPARTMENT

The Colorado Fuel and Iron Corporation has organized a new department to coordinate and expand product research and development, it has been announced by A. F. Franz, President.

The new organization, a part of the Executive Department, will headquarter at Washington, D. C., and operate under the direction of Howard J. Davis, Assistant to the President.

The new department is designed to further the firm's product diversification objectives. The Washington location will enable Colorado Fuel & Iron to broaden its services in the various government agencies and to work more closely with various government and private research and development organizations.

In container ware batch

B_2O_3*

ANHYDROUS BORAX
ANHYDROUS RASORITE
BORAX—BORIC ACID

★ *Speeds melting rate*

★ *Speeds fining rate*

★ *Improves durability . . . appearance*

Container ware manufacturers are becoming increasingly aware of the merits of B_2O_3 as a minor constituent. A primary source of supply is the Pacific Coast Borax Co. with its continuous record of supplying highest quality boron compounds for more than fifty years. One single organization—from mine to refined product—assures top grade.

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DIVISION OF BORAX CONSOLIDATED, LIMITED

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with CAMBRIDGE wire mesh conveyor belts

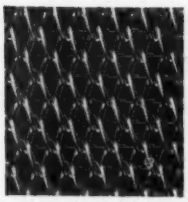
A large producer of medical and biological glassware wanted to boost capacity and efficiency in decorating his product. The cumbersome, two-pass system formerly used required excessive handling, forced high maintenance costs of special fire clay holders, held production rates far below customer demand.

Cambridge engineers, working with the customer's staff, designed the special 6 lane wire mesh conveyor belt installation shown here. Ware to be fired is placed on the belt from six decorating stations at the feed ends of the belts. The moving belts carry the ware through a standard one-pass decorating lehr at 1200° F., completely eliminating manual handling during firing. Specially crimped rods mounted across the belt to hold the ware eliminate the need for fire clay holders. Oxidation resistant alloy wire used in weaving the belt reduces marking of the ware. Open mesh of the belt allows free heat circulation within the lehr, assures uniform production, reduces rejects.

By actual comparison, this Cambridge belt installation allows 3 operators to service 6 loading stations, whereas the former method required 4 operators for only 5 stations!

There's a Cambridge wire mesh conveyor belt for practically any glass or ceramic process that can be combined with movement . . . annealing, decorating, feeder lines, cooling . . . as well as for general use such as for storage or cullet conveyors.

Call in your Cambridge Field Engineer for a discussion of how wire mesh belts can solve your production bottlenecks. Look under "Belting-Mechanical" in your classified telephone book for the Cambridge man nearest you, or write direct.



Cambridge Rod Reinforced Belting is widely used in glass and ceramic plants. It combines high tensile strength with low thermal capacity, assures straight belt travel and resists distorting strains.

FREE BELT MANUAL illustrates and describes wire mesh belts for your industry. Also includes useful metallurgical tables and data on conveyor design and installation. Write for yours

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Here's why you will, too:

Assurance is the premium you receive — at no extra cost — when you buy Wyandotte Soda Ash. This assurance is a priceless quality that will pay off for you over the years. It comes to you in four important ways:

1 **Assurance of dependable supply** through Wyandotte owned-and-operated raw-material resources — salt wells, limestone quarries and coal mines — and expanded production facilities. Wyandotte prides itself in fulfilling customer needs whether soda ash is in long or short supply!

2 **Assurance of uniformity and high quality** through closely controlled production. Constant testing throughout the production process maintains rigid uniformity in each of the many grades of Wyandotte Soda Ash, carload after carload!

3 **Assurance of prompt, economical delivery** because of Wyandotte's central location and easy accessibility to railways and truck lines. Wyandotte Soda Ash is as convenient to you as your telephone!

4 **Assurance of skilled technical help** whenever you require it. Wyandotte, with 63 years of helpful service to the glass industry, has research and technical service staffs anxious to work with you!

Yes, many glass manufacturers have chosen Wyandotte as their source of soda ash supply . . . and for the premium of *assurance* that goes with it . . . year after year. Why don't you do the same? For further information on grades available, shipping data and technical service, contact Wyandotte . . . your inquiry will receive our prompt attention. *Wyandotte Chemicals Corporation, Dept. G, Wyandotte, Michigan. Offices in principal cities.*

RESEARCH DIGEST . . .

(*Continued from page 679*)

a study that is of fundamental importance.

It is not surprising that the studies with the electron microscope by Ray did not reveal the cone structure on a polished glass surface. The electron microscope provides large resolution and magnification of area. At present the practical limit of resolution in depth using shadow casting techniques in conjunction with the electron microscope is of the order of several hundred Angstrom units. Thus, the cones on a polished glass surface which are 60A or less in height could not be revealed by the electron microscope.

The information concerning the mechanism of polishing glass obtained from multiple-beam fringes of equal chromatic order has led to the following tentative picture of a glass surface polished with barnesite. If one could obtain a collection of cones with conchoidal sides, mean height less than 60A, average deviation from the mean about one-third the mean, bases less than 0.01mm. in diameter and then place them as close together as possible with their bases on a super-smooth surface, then one would have a model of a polished glass surface.

• The Industrial Furnace Manufacturers Association has just issued a "Speakers Directory" listing representatives of the industrial heating industry available for talks. Fifty-four speakers offer prepared papers, many illustrated with slides, on subjects covering the whole range of industrial furnaces and ovens and their applications.

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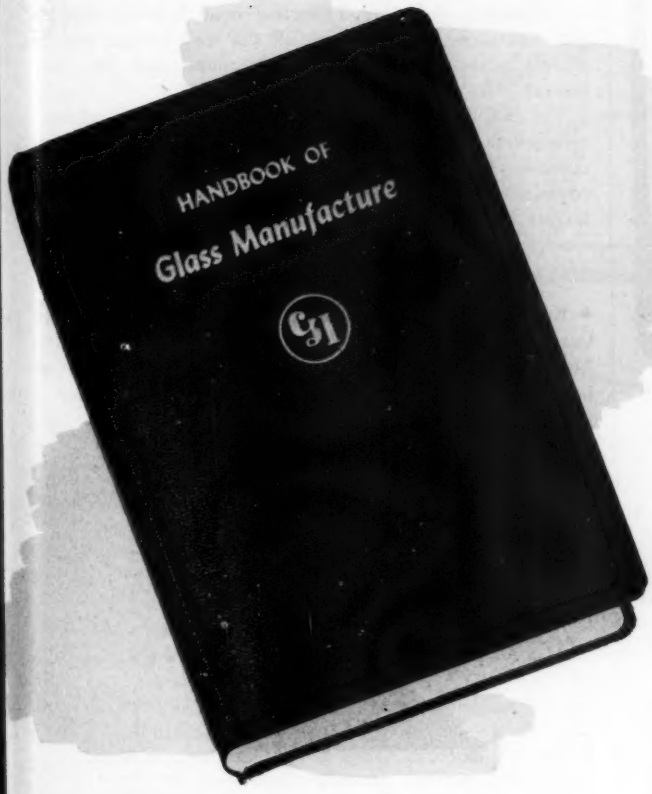

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ETERNAL AS THE SANDS OF TIME

Ottawa Silica Co

Plants located at OTTAWA, ILL. ROCKWOOD, MICH.

DECORATING AT BROCKWAY . . .

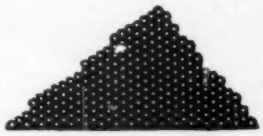
(*Continued from page* 662)

of the glass and applied color. This test will register a loss of color of as little as one micron thickness. The practical result of this testing is that the laboratory can readily spot a bad color that might not show up under a normal visual test.

In keeping with Brockway's policy of producing a diversified line of ware—although the bulk of decorated ware is for the soft drink field, both still and carbonated—the Decorating Department has been called upon to broaden its operations from a standpoint of type of ware that goes to market decorated. Round packer ware and the shampoo line have been sizable items and recently there appears a trend in the whiskey trade for special occasion bottles with colorful, permanently fired on labels and designs depicting historical and holiday events. Sizes of ware decorated run all the way from 1 oz. to 64 oz. capacities, including both round and flat containers.

The company's Decorating Department in Brockway services the area east of the Mississippi River and its capacity of better than 50,000 gross of decorated glass containers monthly assures reliable service to even the largest users of decorated ware.

• Karl Kautz has joined the Research Department of the Ceramic Division of the Vitro Manufacturing Company. Mr. Kautz is a graduate of Ohio State University where he studied ceramic engineering and mineralogy.



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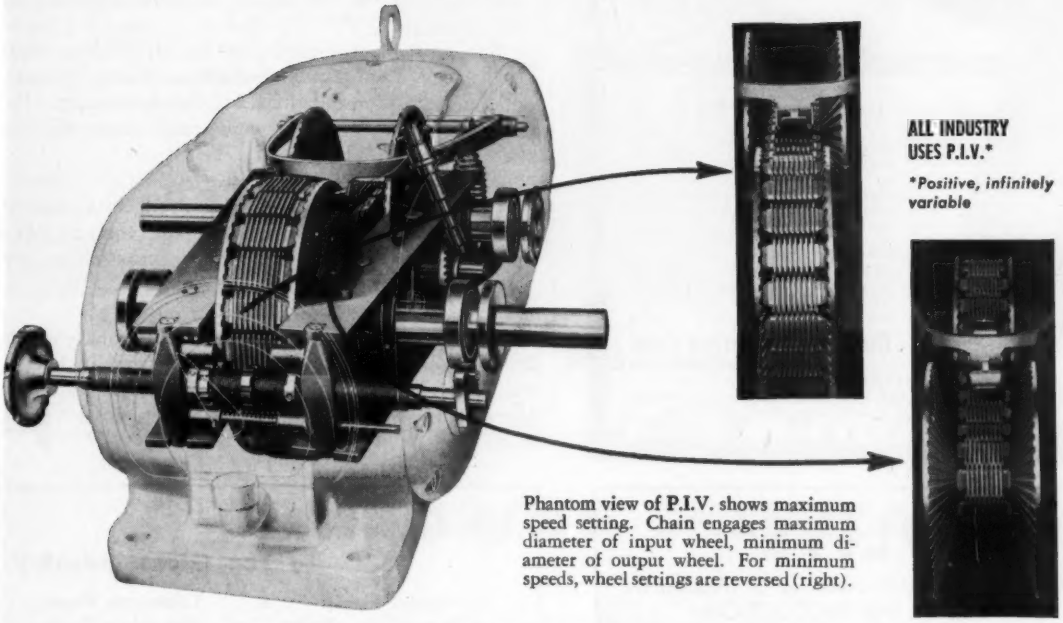

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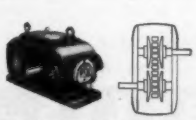

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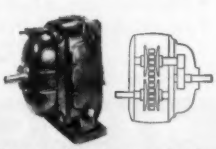
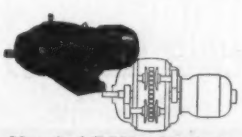
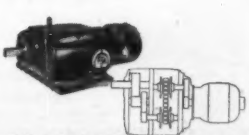


P.I.V. with single reduction input or output helical gears.



Motorized P.I.V. with single reduction input and output helical gears.



Motorized P.I.V. with single reduction input and double reduction output helical gears.

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CORNING STAFF CHANGES

Two organization changes in the Technical Products Division of Corning Glass Works have been announced by Russell Brittingham, Division Manager. J. S. Chowning, Manager of Plant Equipment Sales, has been appointed staff engineer for Standard Products Sales, and sales engineer F. F. Fleischman, Jr. has been named to succeed Mr. Chowning.

Mr. Chowning joined Corning in 1936 as a member of the works control laboratory staff. He was closely associated with the development of glass pipe and pipe hardware and with Multiform processing. He served for a time as a sales engineer in the Industrial Sales Department and in 1950 was named Manager of Plant Equipment Sales.

Mr. Fleischman joined Corning in 1951 as a sales engineer in Plant Equipment Sales, dealing principally with glass pipe installations for the dairy farm. He is a graduate of Cornell University, and received his doctor's degree in 1951.

• The Furnace Division of R-S Products Corporation has announced its incorporation and that it will be known in the future as R-S Furnace Corporation, a subsidiary of Harding Company, Incorporated.

• R. F. Tomlinson, Manager of the Conveyor Department of The Oliver Corporation, A. B. Farquhar Division, has been elected President of the Conveyor Equipment Manufacturers Association at its Twentieth Annual Meeting.

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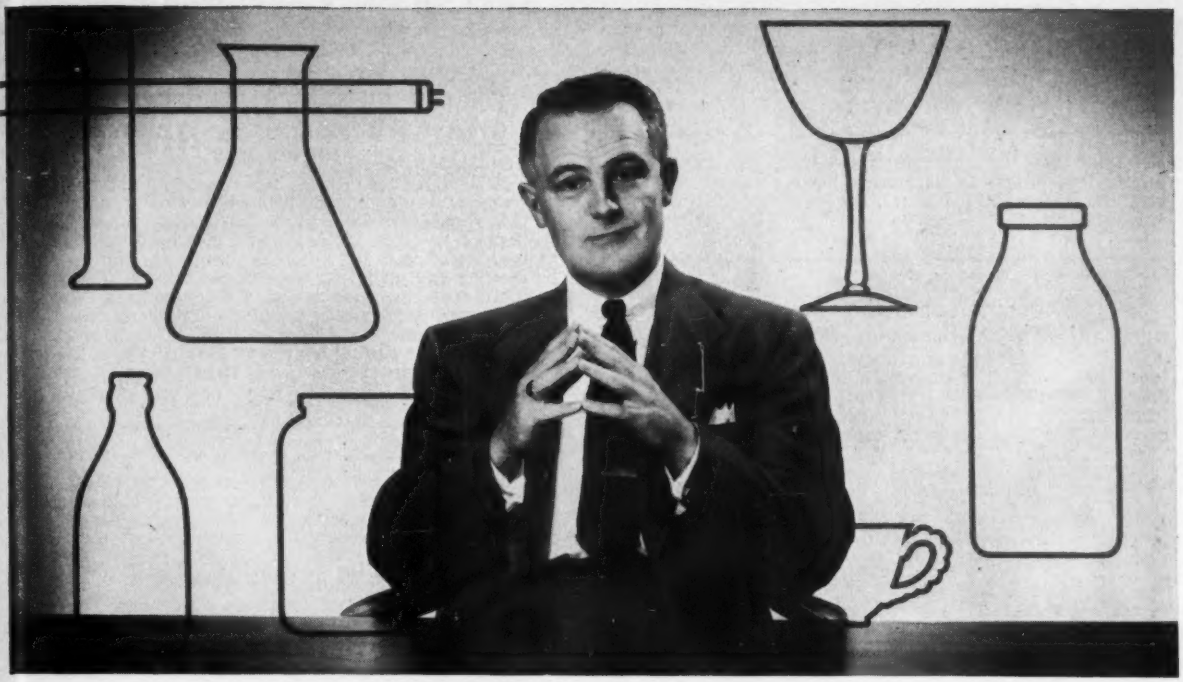

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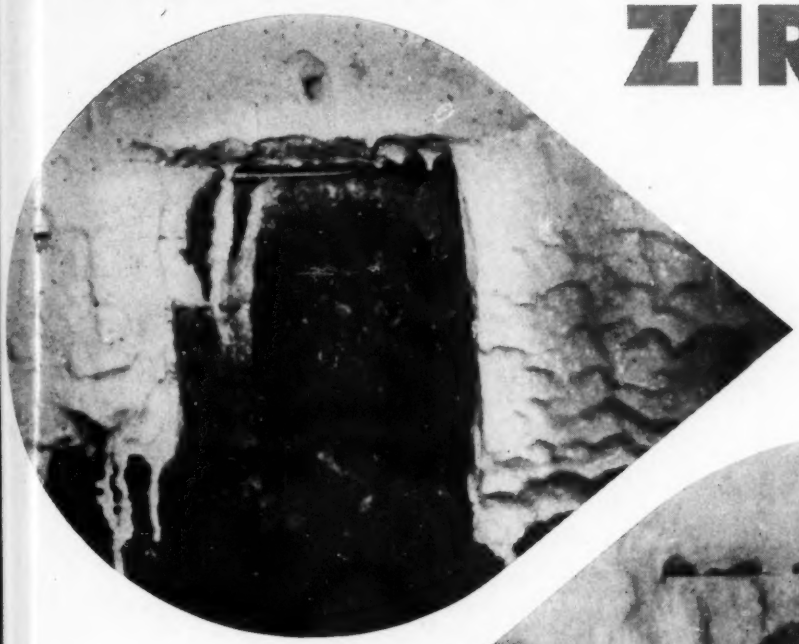

Fig. 1—Bonded mullite peep hole block

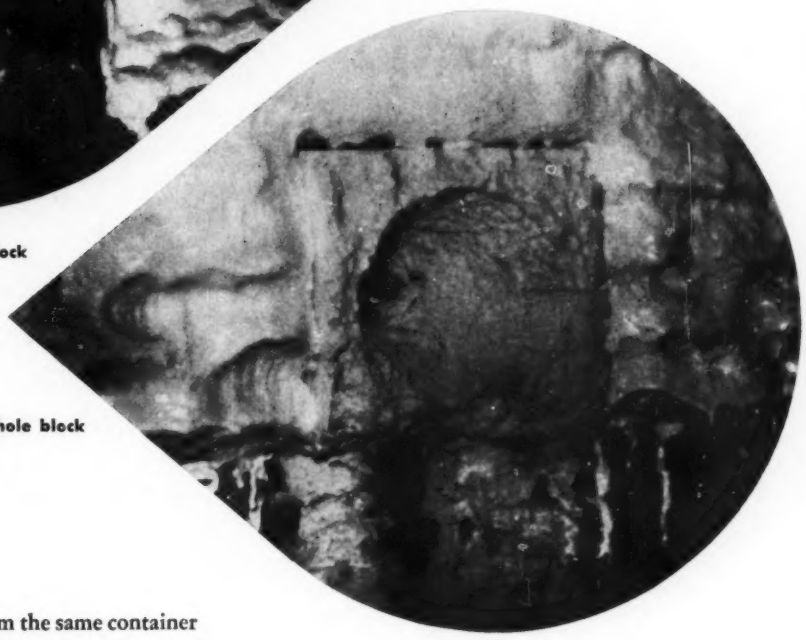

Fig. 2—Taylor Zircon peep hole block

These peep hole blocks are from the same container glass tank and were in service throughout the same 14-month campaign. The bonded mullite block is deeply eroded by silica wash while the Taylor Zircon block (Fig. 2) is still in excellent condition.

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